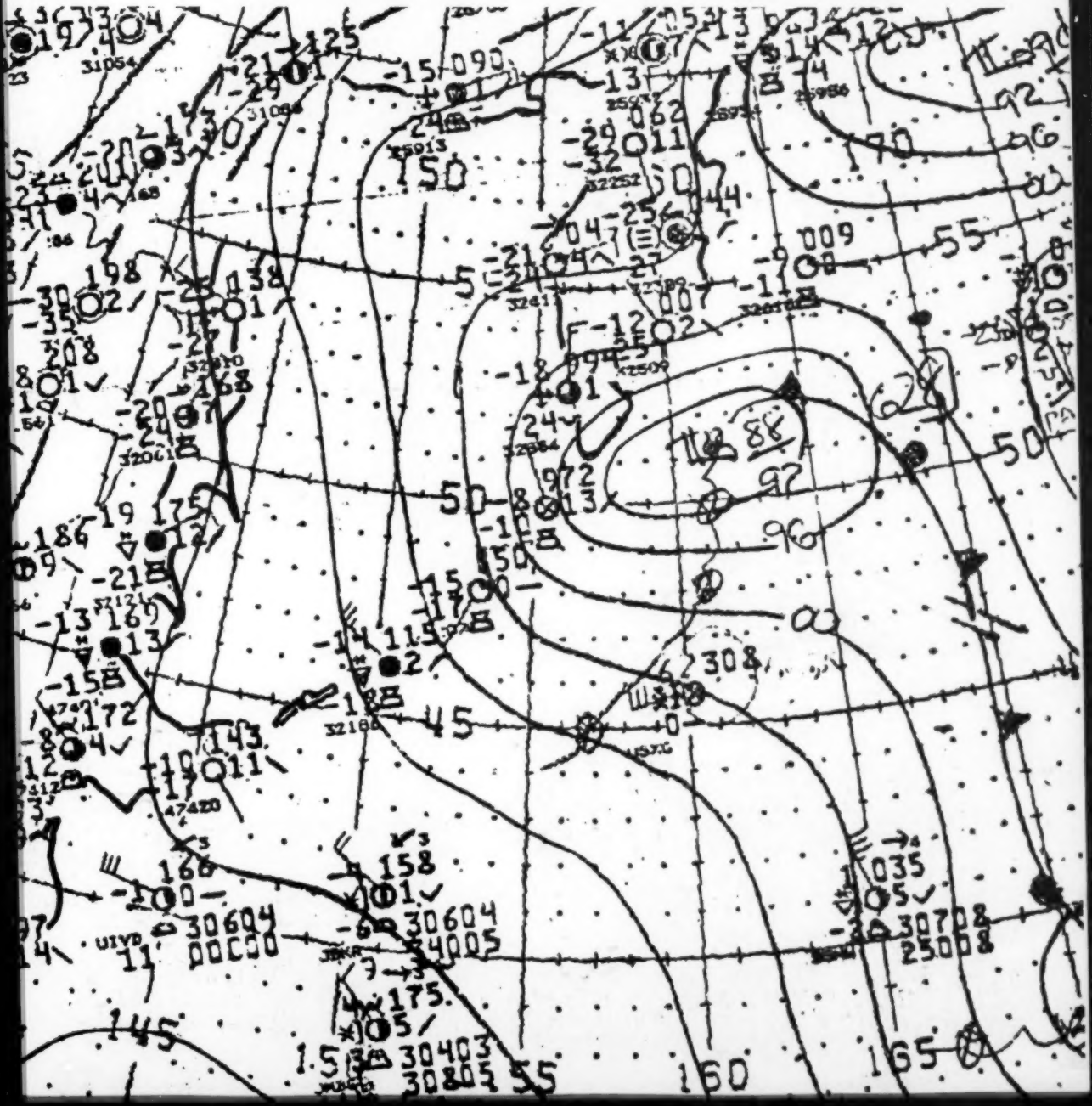
September-October 1981
Volume 25
Number 5

Mariners Weather Log

National Oceanic and Atmospheric Administration • Environmental Data and Information Service • National Oceanographic Data Center



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Mariners Weather Log

Editor: Elwyn E. Wilson
Editorial Assistant: Annette Farrall

September-October 1981
Volume 25 Number 5
Washington, D.C.

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Cover: This is the analysis for 1200 February 14, 1980, by the National Meteorological Center, Washington, D.C., for the area off the Kurile Islands where the SINCERE No. 5 was coated with tons of ice.

The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1983.

The Mariners Weather Log (ISSN:0025-3367) is published bimonthly by the National Oceanographic Data Center, Environmental Data and Information Service, NOAA, Washington, DC 20235 (telephone: 202-634-7394). For address change or cancellation, write to the Editor at this address. Copies are available to persons or agencies with a marine interest by writing to the Editor, Mariners Weather Log. Second-class postage paid to Finance Department, USPS, Washington, DC 20260.

Mariners Weather Log

NORFOLK AS A HURRICANE HAVEN

Geoffrey A. Stevenson, Samson Brand, and
Roger J. B. Turpin
Naval Environmental Prediction Research Facility
Monterey, Calif.

Dick DeAngelis
Environmental Data and Information Service, NOAA
Washington, D. C.

Editor's Note: This is the seventh in a series of articles evaluating the safety of ports as shelters from tropical cyclones. This is an edited version of a more detailed study that will appear in the Hurricane Havens Handbook for the Western North Atlantic and Gulf of Mexico, which will be published by the Naval Environmental Prediction Research Facility and Commander in Chief, U.S. Atlantic Fleet, in the summer of 1982.

While Norfolk hurricanes are rare, old timers can readily recall the two hurricanes of 1933, Hazel in '54, and Donna in '60 (figs. 1.a, 1.b, and 1.c). These storms all created problems in Hampton Roads. Infrequency often leads to complacency, which could mean trouble for any ship relying on Norfolk in a hur-

Figure 1.--Portsmouth Naval Shipyard during hurricane of August 23, 1933: (a) at sea in drydock, (b) waters from the high storm surge pour into the graving dock, and (c) pier under water.

b

c

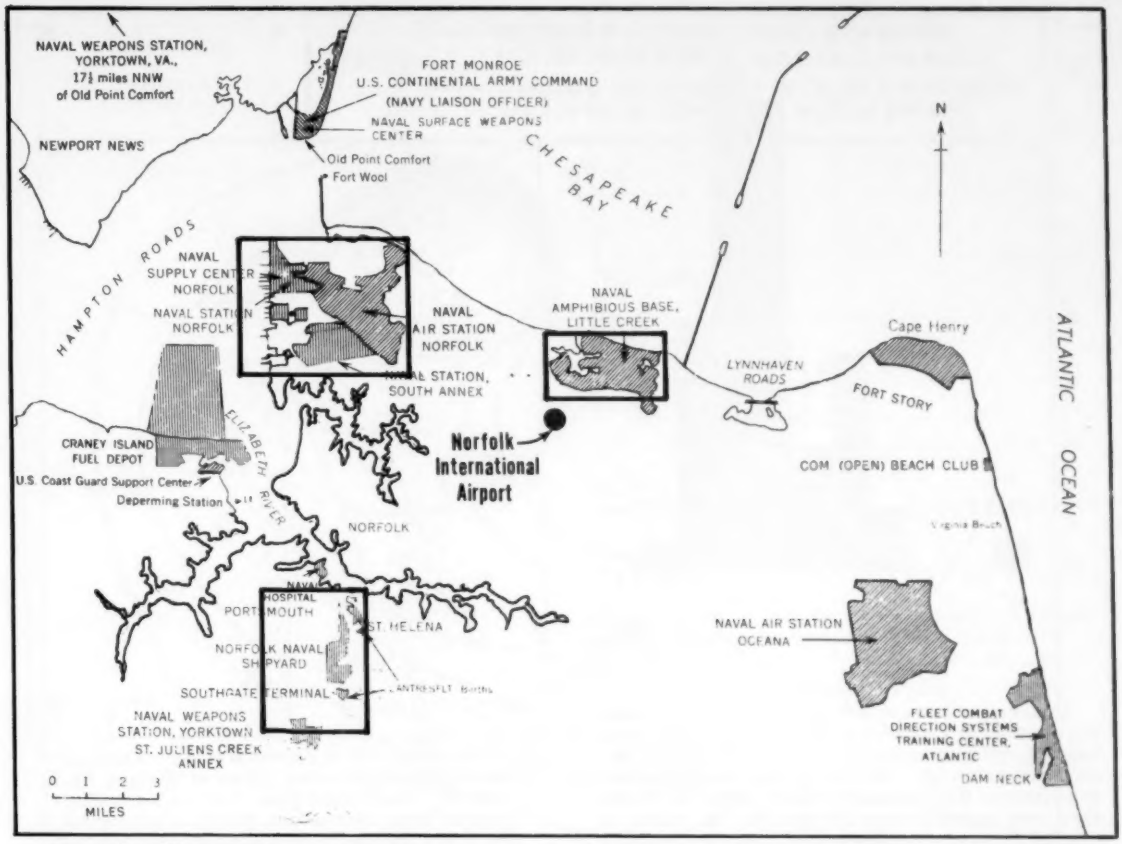

Figure 2.--The general area of Norfolk showing the locations of naval activities and places mentioned in the text.

ricane.

None of the harbors in the Norfolk area are a haven in the rare event of hurricane-force winds. All ships should evade at sea, go to anchor, or if at sea, seek shelter elsewhere. In severe tropical storm conditions (winds 50 to 63 kn), the harbors will provide shelter for most ships, but ships with large sail areas and especially aircraft carriers should evade at sea. Hurricane anchorages in Chesapeake Bay are available. Smaller vessels, fishing boats and sailing craft, and those ships disabled by maintenance should seek shelter in the Norfolk Naval Shipyard or other locations along the southern branch of the Elizabeth River. These conclusions are based mainly on the following factors:

1. The topography of the area is entirely flat and provides very little sheltering from the wind;

2. There is good shelter from wave action in all harbors, except for the Naval Station in westerly winds;

3. There is a significant threat of storm surge.

It is recommended that ships take action as described above at an early stage in the threat situation due to the particularly difficult evasion routes that are likely to be available.

THE SETTING

Norfolk Harbor comprises a portion of the southern and eastern shores of Hampton Roads and both shores of the Elizabeth River and its branches, where the cities of Norfolk, Portsmouth, and Chesapeake are located. Hampton Roads provides access to commercial and naval activities at Norfolk and Portsmouth, shipbuilding and cargo handling at Newport News, as well as many smaller facilities and marinas along the James and Elizabeth Rivers. A natural tidal basin formed by the confluence of the James and Elizabeth Rivers, Hampton Roads is the world's foremost bulk cargo harbor and the scene of the greatest amount of military and shipping activities on the East Coast.

In addition to Norfolk Harbor this study also includes the Norfolk Naval Station, which lies at the eastern shore of Hampton Roads, the Naval Amphibious Base at Little Creek, about 10 mi east of the Naval Station, and the Norfolk Naval Shipyard along the southern branch of the Elizabeth River (fig. 2). For details on Norfolk Harbor and its facilities, see the appropriate charts and publications.

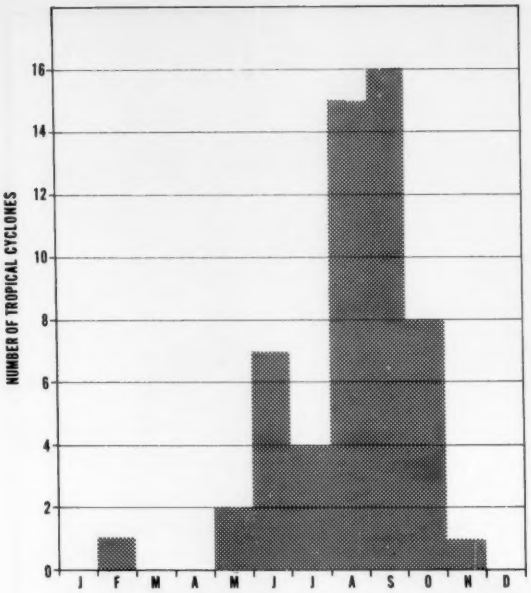

Figure 3.--Frequency distribution of the number of tropical cyclones that passed within 180 mi of Norfolk, Va., 1945-78.

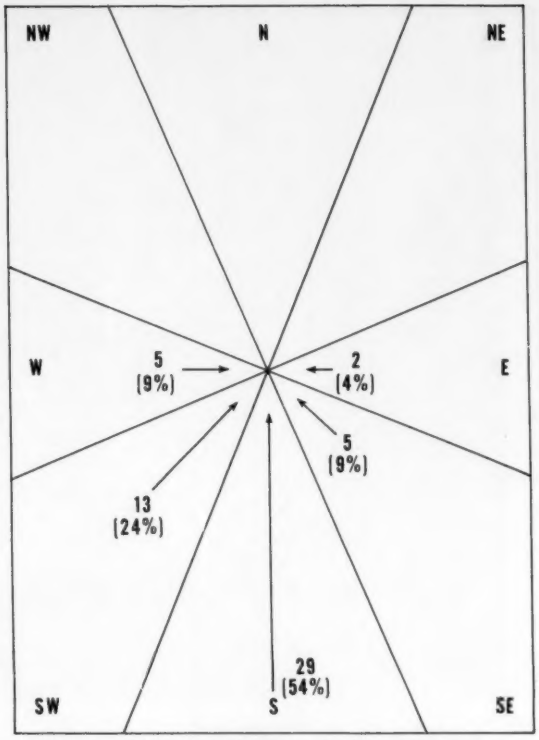

Figure 4.--Direction of approach of the tropical cyclones that passed within 180 mi of Norfolk, Va., 1945-78. Numbers indicate the number that approached from each octant. Numbers in parentheses () are the percentages of the total sample (54) that approached from each octant.

THE CLIMATOLOGY

An average of one or two tropical cyclones threatens the Norfolk area each year. For this study, any tropical cyclone passing within 180 mi of Norfolk is considered a threat. While tropical cyclones can occur anytime, they are most likely to affect the Norfolk area from August through October (fig. 3). Of the 54 tropical cyclones from 1945 to 1978 that have posed a threat, 31 occurred in August and September and 50 threatened during June through October.

At the relatively high latitude (37°N) of the Norfolk area, most storms recurve from a westerly track onto a northerly or northeasterly path. With this change in direction the storms tend to accelerate to an average forward speed of 16 to 18 kn as they pass Norfolk, compared to a 10- to 12-kn average for those storms that remain on a westerly or northwesterly track. Most of the storms that pose a threat approach Norfolk from the south (fig. 4).

The threat of strong winds is usually greatest from those storms whose closest point of approach (CPA) lies to the east of Norfolk, rather than to the west. A storm passing to the west usually has a longer track overland, where its energy supply is reduced and the storm tends to weaken. In fact, no tropical cyclone that was still of hurricane intensity (≥ 64 kn) has passed to the west[1] (table 1). In general, storms passing

[1]Note that extratropical storm Hazel in 1954 passed to the west of Norfolk and caused sustained winds of 50 kn with gusts to 85 kn at NAS Norfolk.

Table 1.--Tropical cyclones which threatened Norfolk, 1945 through 1978, classified by intensity at closest point of approach (CPA) and whether they passed to the east or west

	Hurricane	Tropical storm	Tropical depression*	Extratropical stage	Total
East	17	12	6	8	43
West	0	6	1	2	9

*Two dissipating cyclones with tropical depression intensity approached from due west and are not included. One passed to the north, the other to the south.

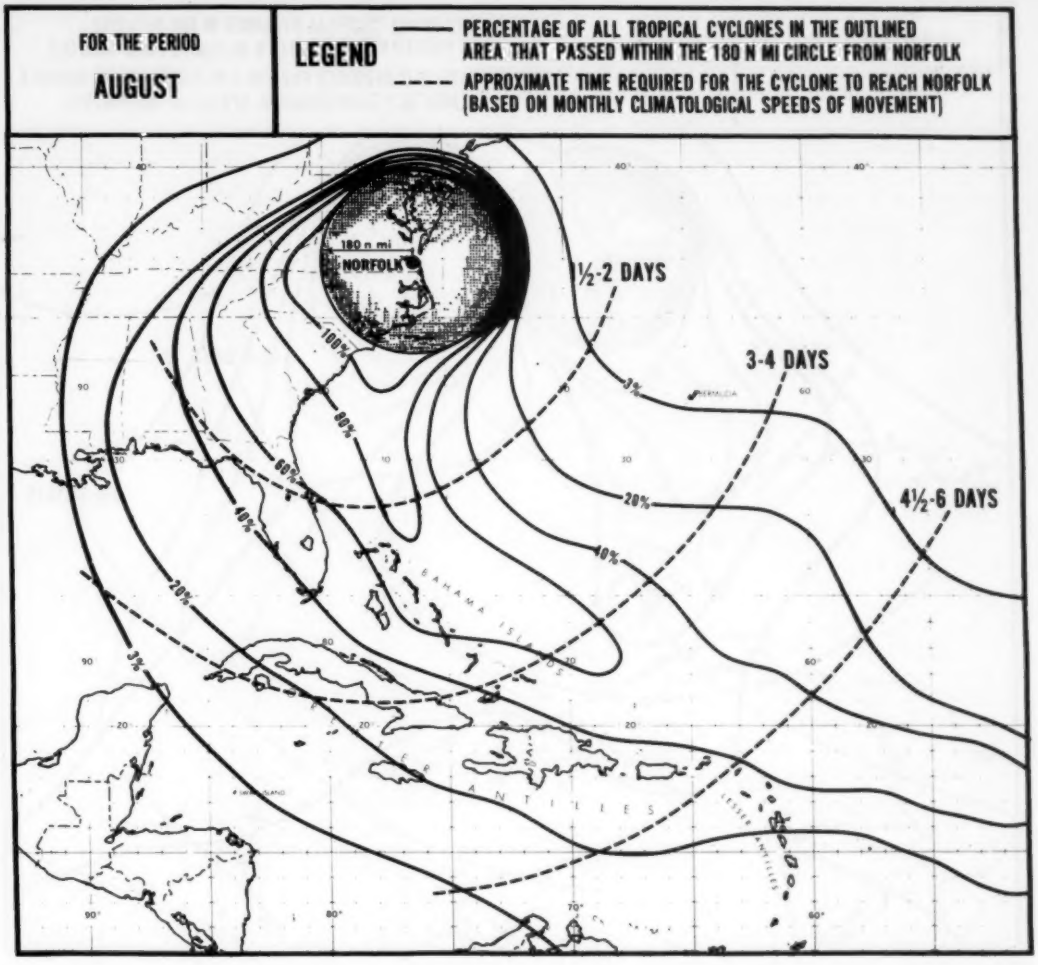

Figure 5.--Probability that a tropical cyclone will pass within 180 mi of Norfolk for the month of August (based on data from 1945-78).

to the east generate northerly winds, while those passing to the west bring a southerly flow.

Figures 5 to 9 are statistical summaries of the threat probability based on tropical cyclone tracks for the years 1945 through 1978.[2] The solid lines represent the "percent threat" for any storm location. The dashed lines represent approximate approach times to Norfolk based on the climatological approach speed for the particular area and direction of movement. For example, in figure 5, a tropical cyclone at 25°N, 66°W, has approximately a 40-percent probability of passing within 180 mi of Norfolk and will reach Norfolk in 3 to 4 days, if the speed remains close to the climatological normal. At the beginning of the main hurricane season in August, the major threat axis is a curve from just east of the Lesser Antilles passing north of the Bahamas, and then recurving up to the North Carolina coast. As the season progresses, the threat axis rotates clockwise so that by October, it follows a line from the Yucatan Channel across the Gulf of Mexico and Florida to approach Norfolk from the southwest. During the remaining months of the year, November through July (the majority of tropical cyclones within this period occur in June and July), a double threat axis exists, combining the two axes mentioned above.

Of the 54 tropical cyclone threats, 32 generated winds of 22 kn or more, while 11 produced winds of 34 kn or more at Norfolk's Naval Air Station (NAS) (based on hourly synoptic reports). Using statistical estimates of sustained winds from peak gusts, based on a procedure developed by Durst (1960), three storms in the 34-yr period 1945-78 generated maxi-

[2]Track information was obtained from Neumann et al., 1978.

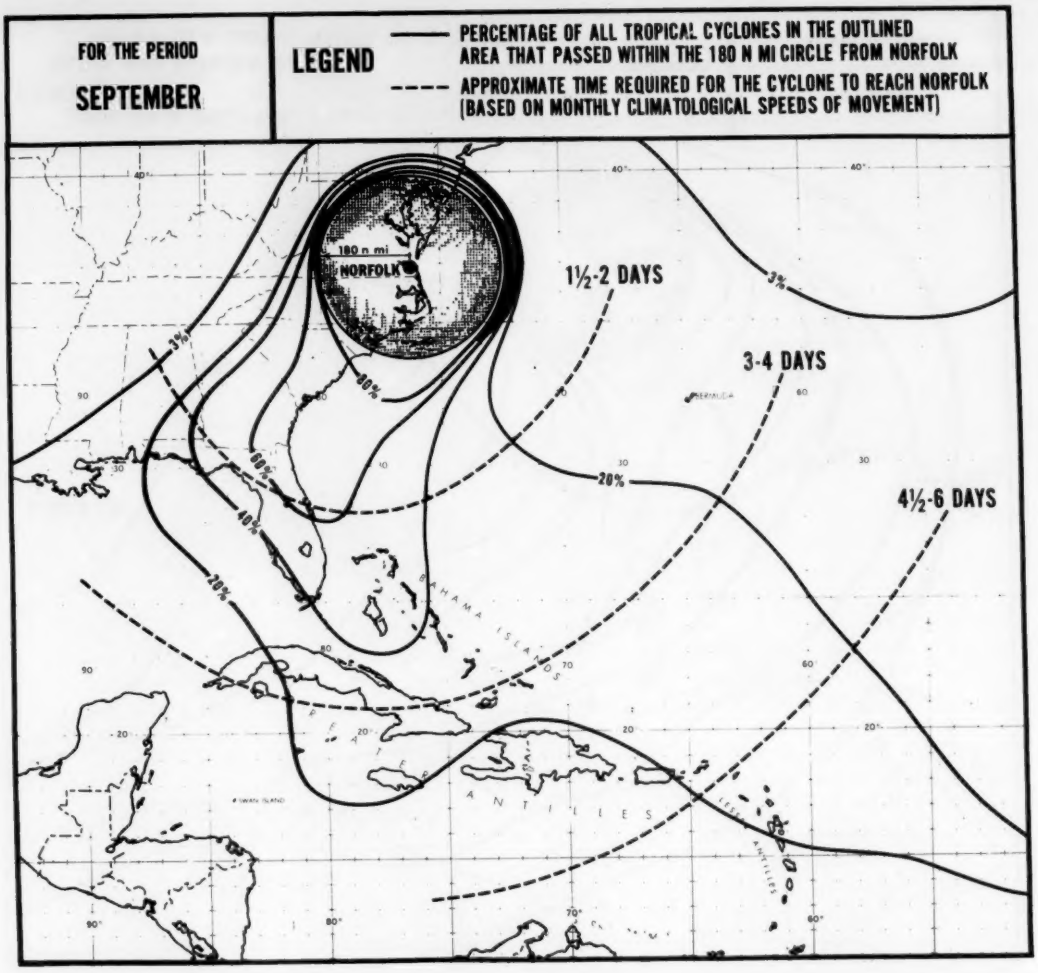

Figure 6.--Probability that a tropical cyclone will pass within 180 mi of Norfolk for the month of September (based on data from 1945-78).

mum 1-min sustained winds of 50 kn or more at Norfolk. They were Barbara in 1953, Hazel in 1954, and Donna in 1960. Earlier records of hurricane effects at Norfolk (Ritter, 1980) suggest a similar frequency of operationally significant winds. The frequency of hurricane-force winds at NAS Norfolk is approximately once every 30 yr compared to once every 6 yr at Cape Henry. Sustained winds of 50 kn or more can be expected about once every 10 yr at the NAS.

Gale-producing tropical cyclones are usually south and east of Norfolk, having approached from the south or southwest (fig. 10). These major threat directions are also shown by the "percent threat" lines of figures 5 through 9 and the octant approach arrows in figure 4. Strong winds ($\geq$ 22 kn) have occurred with the tropical cyclone centers nearly 500 mi away (fig. 11), and gale-force winds have occurred with centers up to 350 mi away. The majority of strong wind cases have occurred with the centers to the northeast, east, or south, consistent with the data in table 1. Figure 12 shows the complete tracks of the tropical cyclones which generated gale-force or greater winds at NAS Norfolk from 1945 through 1978.

Although the land in the Norfolk area is very low and featureless (the average altitude in the area is only 13 ft above mean high water), there is some sheltering from certain directions caused by surface friction. Norfolk Harbor including Norfolk Naval Station is more susceptible to winds from the southwest clockwise to north, and least susceptible to winds from the southeast. The Naval Amphibious Base in Little Creek is most susceptible to northerly winds and least susceptible to southerly winds. Norfolk Naval Shipyard has some sheltering from all directions. Although

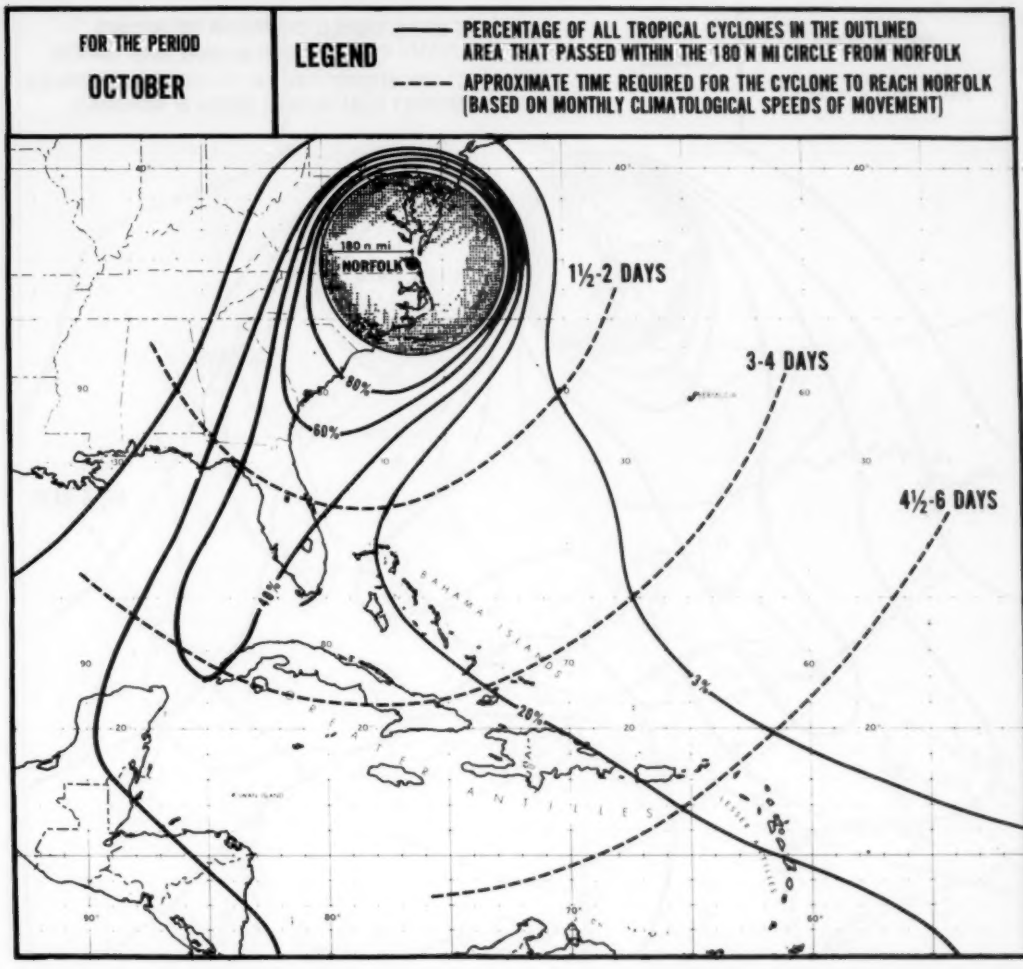

Figure 7.--Probability that a tropical cyclone will pass within 180 mi of Norfolk for the month of October (based on data from 1945-78).

little shelter is offered by topographical features in the Norfolk area, the particular combination of latitude and orientation of the coastline provides protection from the more vigorous cyclones.

Hurricanes at Norfolk are relatively rare as a result of meteorological and topographical factors. Vigorous storms tend to be well to the east, near the Gulf Stream, while storms passing close or to the west of Norfolk are likely to be weakened by their relatively long land track. The two most destructive cyclones at Norfolk this century possessed unusual features. Hurricane No. 8 in August 1933 approached Norfolk on a northwesterly track and by this unusual direction of movement maintained its intensity by minimizing its land track. Hazel in 1954, however, was passing well to the west, having become extratropical at its CPA, whereupon it was invigorated by encountering a strong cold outbreak from the northwest.

Wave heights generated by tropical cyclone winds are dependent upon wind direction, strength, and harbor location. Norfolk Naval Station is protected from open ocean swells and also from seas generated over the long fetch of northerly winds in Chesapeake Bay. Winds out of the west through northwest can generate hazardous seas at the piers. These conditions would be at their worst after the close passage of the eye of a tropical cyclone with the center to the north or northeast. Fortunately, most tropical cyclones affecting the port pass well to the east and, therefore, will be at a considerable range from Norfolk before westerly winds are experienced. Lynnhaven Roads and the Little Creek Naval Amphibious Base are susceptible to northerly seas generated in Chesapeake Bay. Since the southern end of the Bay is shallow,

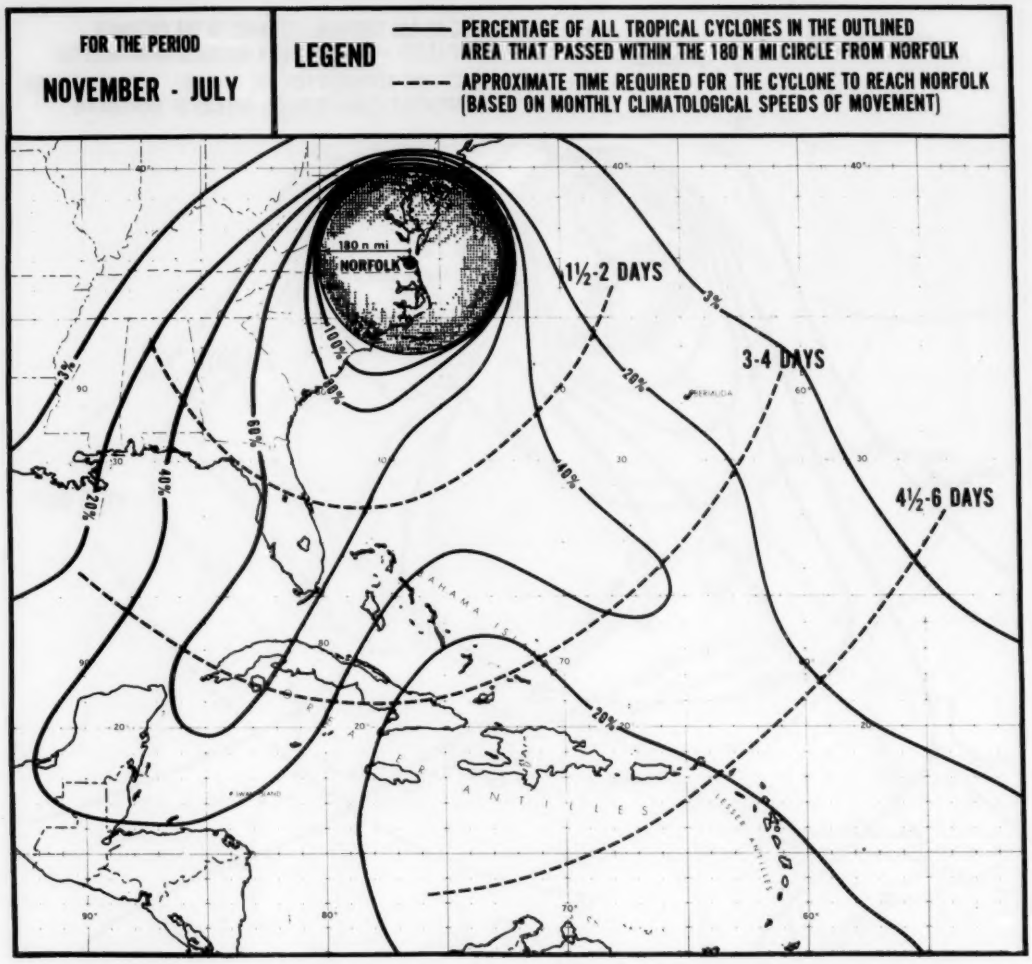

Figure 8.--Probability that a tropical cyclone will pass within 180 mi of Norfolk for the months of November through July (based on data from 1945-78).

any large waves generated in the deeper central portion will tend to break offshore. Waves of 8 to 10 ft generated by 50-kn winds in the central Bay could be expected to be reduced to 5 to 6 ft at the southern end. Even in a 90-kn plus wind, it is unlikely that waves greater than 12 ft could be supported in the shallow southern end, but conditions in these breaking seas would be treacherous. Ships off Lynnhaven Roads are also susceptible to large ocean swells.

Storm surge, the difference between the observed and expected water level, varies considerably even over short distances. The highest surge that Norfolk has ever experienced at the Sewells Point gage was 6.2 ft in August 1933. Since it occurred at high water, the actual storm tide was 9.7 ft. Winds blew out of the northeast at about 60 kn. The maximum predicted surge using a computer model for the worst possible storm situation is approximately 11.5 ft at Cape Henry. This would result from a hurricane with maximum winds of 120 kn moving due west towards Norfolk and landing some 15 mi south of Cape Henry. The whole region is prone to high surges generated by northeasterlies. Winds from a southerly quadrant may cause a negative surge resulting in lower low tides than predicted. Tides and currents in the Norfolk area are usually not a problem. It is only when they come under the influence of strong winds that difficulties arise.

THE DECISION

The most important aspect of any decision concerning heavy weather is an early appraisal of the threat posed by an individual tropical cyclone. Tropical cyclones which cross Florida or the Bahama Islands and

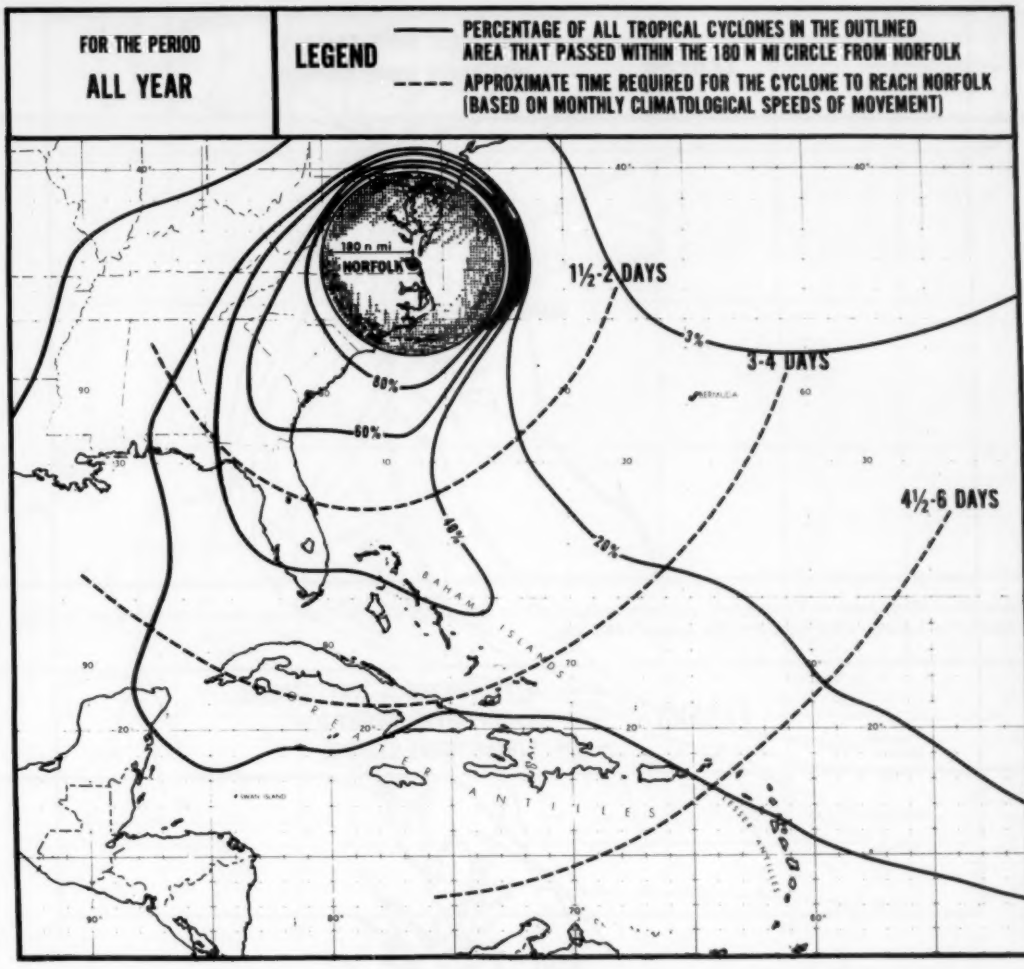

Figure 9.--Probability that a tropical cyclone will pass within 180 mi of Norfolk for all the months of the year (based on data from 1945-78).

finally recurve northward have in the past had a relatively high probability (40 to 60 percent for the whole year) of passing within 180 mi of Norfolk. Any decision to sortie from Norfolk must be made early in order to gain maneuvering room in the open ocean, especially since large swells are likely to be encountered even though the storm may well be far to the south.

An unfortunate consequence of an early decision is of course that the tropical cyclone forecast errors will be greater, both for the center position and for the intensity. The tendency is to delay an evasion decision in order to obtain more accurate updated information. This is the dichotomy that the decisionmaker must face, and it is worsened by the additional economic constraints of fuel conservation.

Remaining in port when the means to evade a storm is available is a decision contrary to most of the traditional rules of seamanship. However, the final decision will depend on many factors, including the forecast wind intensity at the port and the track of the storm. Characteristics of the individual harbor must also be taken into account for each individual ship. The following should be considered:

Norfolk Harbor and Norfolk Naval Station

1. Norfolk Harbor, including the Naval Station, is not a haven for aircraft carriers or other ships with a large sail area. When sustained winds of 50 kn or greater are expected, such ships should sortie at the earliest opportunity and evade at sea.

2. Smaller ships should sortie on the rare occasions when hurricane-force winds ($\geq$ 64 kn) are expected.

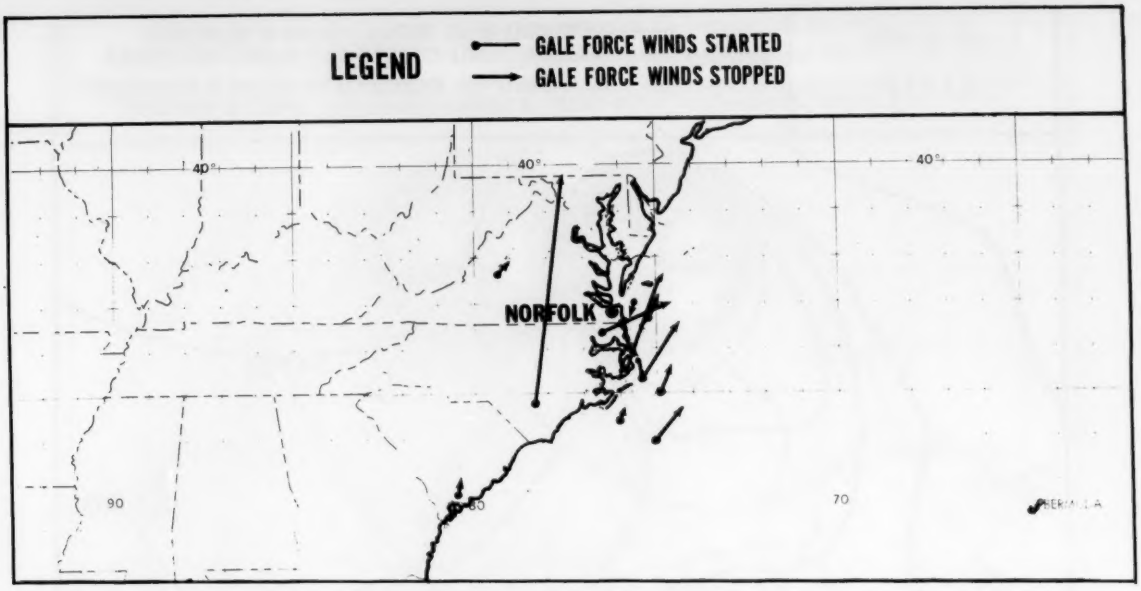

Figure 10.--Positions of 11 tropical cyclone centers when 34-kn winds first and last occurred at NAS Norfolk (based on hourly wind data for the years 1945-78).

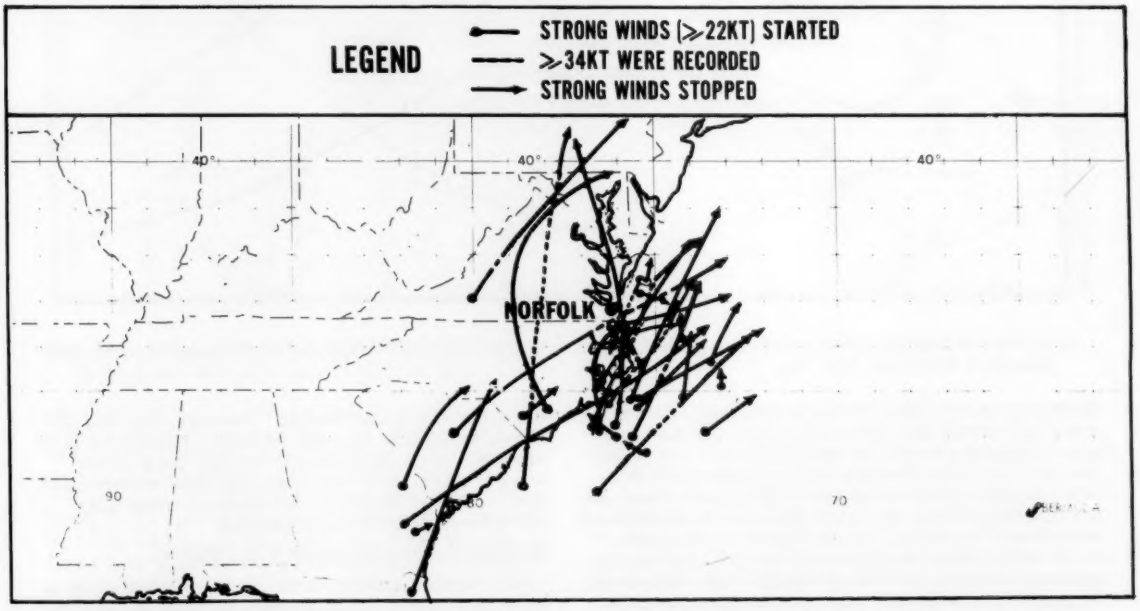

Figure 11.--Positions of 32 tropical cyclone centers when 22-kn winds first and last occurred at NAS Norfolk (based on hourly wind data for the years 1945-78).

3. Those ships seeking shelter in the harbor should obtain a berth on the windward side of the pier when possible. The ships should increase the number of lines and keep a close watch on the lines in case of storm surge. The maximum storm surge will not necessarily occur at the same time as the strongest winds.

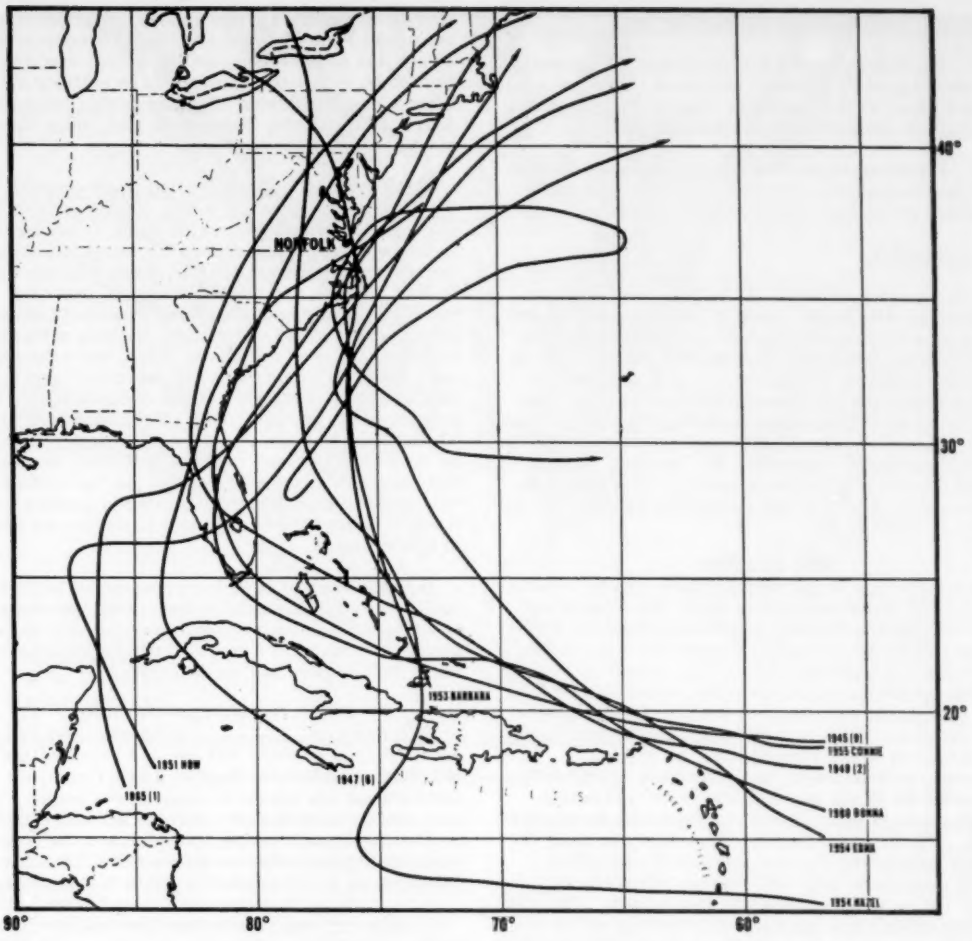

Figure 12.--Tracks of 11 tropical cyclones resulting in winds $\geq$ 34 kn at NAS Norfolk (based on data from 1945-78).

4. Wave conditions at the Naval Station piers will be far worse for any particular wind strength if the wind has a westerly component rather than an easterly component.

5. Storm surge will be at its worst with northeasterly winds, especially when its effects are compounded by high astronomical tides.

Naval Amphibious Base, Little Creek

1. The controlling depth is only 18 ft (5.5 m), and the base will normally only be used by shallow- or medium-draft amphibious ships.

2. The harbor provides good protection from sea and swell, but not necessarily from wind and storm surge. Northerly winds produce the greatest hazard in terms of both wind strength and surge height.

3. Ships will normally sortie only if a sustained wind is forecast that will make the berths untenable. This will vary for each ship, but is expected to be over 60 kn (i.e., a rare occurrence).

Norfolk Naval Shipyard

1. Most ships will not be in a position to sortie and should be secured as well as possible.

2. There will be a great demand for berths due to the shipyard's good small boat haven qualities. Requests and movements should be made early in order to avoid last-minute confusion.

3. Any large storm surge will cause an enormous problem, and a watch should be kept at all times to avoid boats breaking their mooring lines and becoming a problem for other vessels.

Hurricane Anchorages in Chesapeake Bay

1. The bottom depths are convenient for anchoring, and should provide adequate underkeel clearance even in the highest seas possible as long as the deep draft ships go to the northernmost anchorages.

2. Maximum separation between occupied anchorages perpendicular to expected wind direction will minimize the damage threat should ships break loose.

Tug Availability

Commanding officers of vessels who may be required to shift berth, move to an anchorage, or put to sea in the event of a tropical cyclone affecting the Norfolk area should bear in mind that the services of the limited number of tugs will be at a premium before and after the passage of a tropical cyclone. Demand for tugs will be particularly high at certain stages of the tide and during normal working hours. Calls for towage assistance, especially for smaller vessels, should therefore be kept to a minimum and should be made only in case of a real emergency as when life and ships are endangered.

THE EVASION

Evasion at sea is the recommended course of action for aircraft carriers or other ships with a large sail area when severe tropical storm conditions are expected and for all seaworthy vessels when hurricane conditions are expected. Due to the latitude of Norfolk and the orientation of the coastline, conditions of this sort are rare at the piers and would normally only be expected if an intense tropical cyclone was threatening to track close with a limited overland trajectory. When evasion is contemplated, the importance of correctly assessing the threat posed by the storm and acting quickly so as to retain flexibility cannot be overemphasized. The nature of the coastline makes an early departure imperative if a real threat is in the offing.

The decision to sail, once taken, poses a new problem of the best course of action once at sea. The commanding officer, with his detailed knowledge of his ship and crew, must always make his own personal decision as the situation dictates. The following describes the most likely threat situations and recommended courses of action. In reality, of course, each threat must be considered on its own merits.

1. A tropical cyclone moving along the coast from the Florida area and forecast to pass to the east--This undoubtedly is the most common threat and carries the possibility of high surges. Unfortunately, it is also the most difficult to evade. First, an early departure is imperative in order to cross ahead of the storm as there is little choice but to steam due east in order to obtain sea room in which to maneuver. This is likely to be followed by steaming southeast to avoid the likelihood that the storm will recurve northeastward and accelerate.

2. A tropical cyclone moving up from the Florida area and forecast to pass to the west of Norfolk--This situation is less common and does not pose as big a threat as case 1. The winds produced by the cyclone at Norfolk would generally be southeasterly veering to westerly as the cyclone passed. In order to justify evacuation, the expected CPA would have to be very close, say within 60 mi, or the cyclone would still have to be very intense, which is an unlikely situation after a long land track. Evasion is also relatively easy. After leaving Chesapeake Bay, ships should steam southeastward.

3. A tropical cyclone moving northwestward and forecast to pass north or within 100 mi south of Norfolk--Although such a threat is rare, it has happened in the past, and it has caused the worst conditions ever recorded (August, 1933). Early evasion would be best with the ship advised to steam past Cape Hatteras and escape southwestward towards Florida, before the seas ahead of the storm buildup sufficiently to impair the ship's advance. Also, the wind and seas would be from astern and relatively favorable. For those who delay the evasion decision in this case, problems will mount rapidly. If the evasion route around Cape Hatteras becomes impossible, there is no choice but to steam northeastward into headwinds and seas. Progress will be slow and the cyclone may well recurve toward the north to make matters worse. It would be preferable to go to a hurricane anchorage in this situation.

Other cases will have to be considered individually. Also, a close watch must be kept on all warnings, even after the danger has apparently passed. There is always a possibility of a tropical cyclone stalling or looping to rethreaten a particular location.

THE ANCHORING OPTION

Hurricane anchorages in Chesapeake Bay will normally be used by ships that decide to sortie from Norfolk Harbor, the Naval Station, Little Creek, or the Shipyard and are unable to evade at sea easily. They may also be used when the harbors are expected to become marginally unsafe, but when evasion at sea would be impracticable or uneconomic. In either case, the following factors should be taken into account.

1. The mud and sand bottom is considered good holding ground.

2. Maximum wave heights will be between 10 and 14 ft for northerly winds of hurricane strength. For winds not along the axis of the bay, wave heights will be considerably less.

3. There is a possibility of ships dragging anchor and becoming a hazard to other ships at anchor unable to take avoiding action. A second anchor should be ready for dropping at any time or should be dropped anyway to reduce yawing.

4. There is a high probability that some of the numerous small vessels and barges seeking shelter in the upper part of Chesapeake Bay will be improperly secured and will come adrift. These drifting hulks will be a deadly threat to any ships anchored in their path.[3]

[3]Refer to DMA Hydrographic/Topographic Center Fleet Guide Hampton Roads for more detailed information on hurricane anchorages.

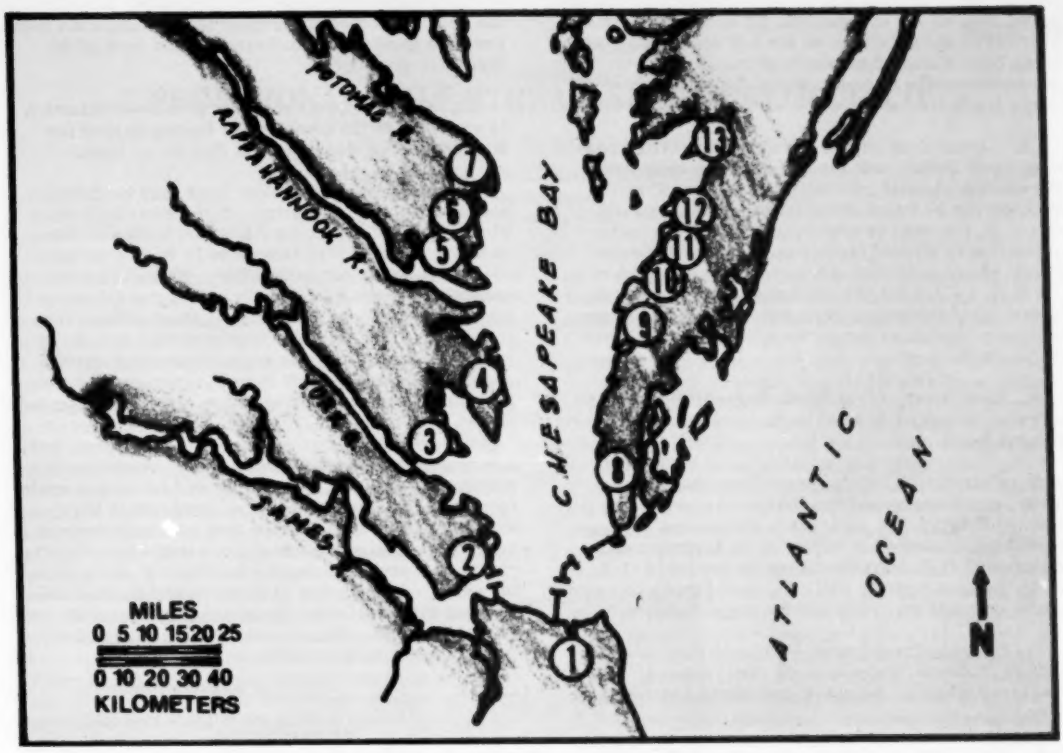

Figure 13.--Recommended hurricane holes for small vessels.

SAILING BOATS AND SMALL FISHING VESSELS

Sailing boats and small fishing vessels obviously must seek shelter in a harbor whatever the expected wind conditions are. The best solution is to remove the boat from the water altogether at the earliest opportunity and secure it well away from the effects of possible surge. For those unable or too late to remove their vessels from the water, they should locate well protected berths or moorings before the start of the hurricane season. Within the Norfolk area there are many tributaries of the Elizabeth River, especially the southern branch where small boats can find shelter. It must be remembered, however, that the boat should be tended throughout the threat period in order to prevent the breakage of mooring lines if a surge occurs.

The following are a few of the so-called "hurricane holes" available to small boats around the Chesapeake Bay and is extracted from "The Cheaspeake: A Boating Guide to Weather," by Jon Lucy, Terry Ritter and Jerry LaRue, published in 1979:

> Although hurricanes are rare in Chesapeake Bay, near-hurricane-force winds (> 64 kn) are not uncommon because of severe thunderstorm activity and summertime squalls. This makes it important for boatmen to know the location of well-protected harbors that provide good landlocked water with adequate depth for deep draft vessels. So-called "hurricane holes" are present in most Bay tributaries, according to Julius Wilensky in "83 Hurricane Holes of the East Coast" (Sea Magazine, August 1978, CPS Publications, Inc., N.Y., N.Y., Copyright 1978). Locations of hurricane holes follow (fig. 13), as recommended by Wilensky and Jon Lucy (indicated by an asterisk).

Western Shore

1. Linkhorn Bay, off Lynnhaven Bay above Cape Henry*--Enter Lynnhaven Inlet cautiously because of a shifting bar, but anticipate a well-marked entrance channel with water depths of 6 to 10 ft (1.8 - 3 m); the Inlet and the east channel towards Linkhorn Bay are crossed by fixed bridges with 35 ft (10.7 m) clearances; after entering the Inlet, swing wide to the left towards the Great Neck Road Bridge and proceed into Broad Bay, then through the 6 ft (1.8 m) deep Narrows into Linkhorn Bay; protected anchorages can be found in both the south and east branches of the Bay to either side of Bird Neck Point, with shoreside facilities at the ends of each branch.

2. Hampton River, north shore inside Hampton Roads*--Cross Hampton Roads Bridge Tunnel and enter the channel to the right behind the Tunnel island; as you enter the mouth of Hampton River, be

on the lookout for commercial tug and barge traffic; proceed up Sunset Creek on the left where two marinas handle limited numbers of transient boats; do not anchor in the Hampton River channel because of barge traffic and the River's northeast orientation.

3. Lower York River, north shore*--After passing Sandy Point, look for day markers indicating the winding channel into the Perrin River where dockage can be found at the large marina. Drafts of 7 ft (2.1 m) can be accommodated. Even better protection is offered farther up the river in Sarah Creek where good anchorages with water depths of 7 to 8 ft (2.1 - 2.4 m) are available in the northwest branch up to the repair yard and marina, and in the northeast branch as far as the oyster packing house on the north shore.

4. East River, off Mobjack Bay--Anchor either in Putam Creek or in East River itself, south of Woodas Point.

5. Corrotoman River, lower Rappahannock River, north shore--After clearing the power cables (50 ft or 15.2 m clearance) along Grey's Point bridge, anchor in either of the Corrotoman's branches; 7 ft (2.1 m) drafts can be carried 2-1/2 mi up the east branch, while the west branch can handle 8 ft (2.4 m) drafts for the same distance.

6. Dividing Creek, north of Fleets Bay, about midway between Rappahannock and Potomac Rivers--Anchor up the creek just above Lawrence Cove.

7. Horn Harbor, about 5 mi up Great Wicomico River, north shore--This is the best of several well-protected creeks going upriver.

Eastern Shore

8. Cape Charles Harbor*--This harbor of refuge located 9 mi north of the Cape itself can provide protection with transient docks located in the northeast corner behind the Coast Guard Station; for boats drawing less than 5 ft (1.5 m), Kings Creek just north of the harbor also offers protection as well as marina services, but the channel markers must be followed carefully.

9.-10. Occohannock and Nandua Creeks*--Some protection can be found in Occohannock Creek up to the area of Davis Wharf, beyond which water depths drop below 7 to 8 ft (2.1 - 2.4 m). Nandua Creek to the north has a somewhat tricky, winding channel bordered by shoals, but with care, protection can be found by running up to Nandua.

11.-12. Pungoteague and Onancock Creeks*--Good protection is found up Pungoteague Creek in the area of Harborton; farther north Onancock Creek provides good storm anchorage in the area of the Onancock town dock.

13. Saxis, upper Pocomoke Sound*--Protection is available in the commercial fishing harbor for boats requiring depths of 6 ft (1.8 m) or less.

The anchorages mentioned here may be crowded because of their popularity. If you must look elsewhere for good protection, look for bodies of water in which an extra high tide up to 12 ft (3.7 m) above mean high water can be handled. If you are actually expecting the eye of a hurricane to come ashore in your area, the best protection in the Northern Hemisphere is in the left rear quadrant with respect to where the storm's eye is expected to intersect the coast (determine the left rear quadrant while facing away from the approaching storm along its projected track).

In seeking protected anchorages, remember that a hurricane usually will produce east or northeast windspeeds of 70 to 100 kn, followed by lesser winds from the west or northwest. A hurricane's high winds and tides also require that anchor line scope be increased from the usual 7 to 1 ratio to a 10 to 1 ratio. If a protected harbor has limited swing room for anchored craft, two anchors should be used 180 opposed to each other. Reduce the likelihood of dragging by anchoring in sand or hard mud rather than grassy bottom or soft mud.

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Mariners Weather Log

A PROVISIONAL GULF STREAM SYSTEM CLIMATOLOGY

Stephen Baig, Donald Gaby, and John Wilder[1]
Satellite Field Services Station, NOAA
Miami, Fla.

Since the first description of the Gulf Stream in 1513 by Ponce de Leon, mariners have taken advantage of this great ocean current. For centuries afterward, European colonists and explorers coming to the Americas would follow the tradewinds to the West Indies, after the example of Columbus. When heading back to Europe, they would seek out the Gulf Stream System[2] on the northwestern side of Cuba and ride the current for much of the passage home. Near the time of the American Revolution, Benjamin Franklin, then Deputy Postmaster General for the North British Colonies in America, using information gained from whaling captains, published the first chart of the Gulf Stream with sailing instructions to take advantage of the Stream. Franklin was the first to suggest use of ocean temperatures when seeking to locate the Stream. During the 19th and 20th centuries many researchers studied the Gulf Stream. Marine atlases were published that gave, in a general way, the location of the maximum current. However, not until the era of environmental satellites were men able to make comprehensive observations of the Stream that were of immediate use to mariners.

The first environmental satellite was launched by the United States in April 1960. It was known as TIROS-1, an acronym for "Television Infrared Observation Satellite." The revolutionary pictures of clouds and weather systems soon were being used by weather forecasters and now are familiar to nearly everyone. Not so well known were the early infrared picutres of the ocean which clearly showed the warmer waters of the Gulf Stream System and promised to be a useful tool for mariners. By 1966 the United States had introduced an operational satellite system, using polar-orbiting satellites, that provided full coverage of the entire world at least once daily. In January 1973 the National Earth Satellite Service (NESS) began producing a weekly analysis of the Gulf Stream using these infrared images. These analyses typically showed the shoreward edge of the warmer water, meanders and detached eddies, and sometimes the offshore edge of the warmer Gulf Stream water. Cloud cover and infrequent viewing by the polar-orbiting satellites prevented more frequent analyses. In 1974 the United States launched the first of a new series of satellites to be known as GOES, an acronym for "Geostationary Operational Environmental Satellite." The GOES satellites provide continuous viewing of almost an entire hemisphere with both visible and infrared pictures every 30 min. The GOES satellites, although providing lower infrared spatial resolution, provided the opportunity of viewing the entire Gulf Stream System in a single image, and the frequent imaging avoided some of the difficulties of obscuring cloud cover. The operational GOES-East satellite, located 35,800 km (22,300 mi) above the Equator at 75°W longitude, regularly views almost all of the Atlantic Ocean.

NOAA's Satellite Field Services Station (SFSS) in Miami, Fla., one of seven field stations operated by NESS, was established in 1974 and began using the new imagery available from the GOES satellites. An SFSS oceanographer, together with a colleague at the NOAA Atlantic Oceanographic and Meteorological Laboratories, developed a new technique for deriving the location of the Gulf Stream System using animated GOES imagery. Especially enhanced infrared images are viewed much like a time-lapse movie. In such animated imagery, the Gulf Stream System appears essentially stationary, while most clouds move through the scene. Thus, even with extensive cloud cover, it is usually possible to distinguish the edge of the warmer water marking the location of the Stream. Early efforts used only such imagery acquired during the night hours, but for the past 2 yr daily 24-hr animated sequences have provided continuous viewing of the Gulf Stream System. A regional operational product, the Gulf Stream System Flow Chart, evolved to meet user needs. It is prepared three times weekly, but daily analyses have been made since 1975 and are the data base from which this provisional climatology of the Gulf Stream System was constructed.

To construct the climatology, data were analyzed for November 1976 through October 1980, which allowed 4 yr of analyses for each individual month. (Data for the years 1974-75 were not used because the analysis techniques were being developed during that period.) The analyzed features for each day of a month were traced onto a separate base chart for that month of a particular year. The positions of the mean of both the inshore and offshore edges of the warmer water were then subjectively determined. For each month of the 4-yr data set, the mean of the means of both the inshore and offshore edges and the extreme inshore and offshore positions of both edges were subjectively determined. The data were treated in this way to avoid the overweighting effect that any one year's data might have if other years had less data.

The number of years of data contained in each

[1] LTJG John D. Wilder is now assigned to the NOAA Corps training facility at Kings Point, Long Island, N.Y., where he is instructing cadets in the handling of large vessels.

[2] The term "Gulf Stream System" has been used to avoid ambiguity and is meant to include the Gulf of Mexico Loop Current, the Florida Current, and the Gulf Stream proper. This ocean current system is routinely analyzed from the Yucatan Channel eastward to near 45°W.

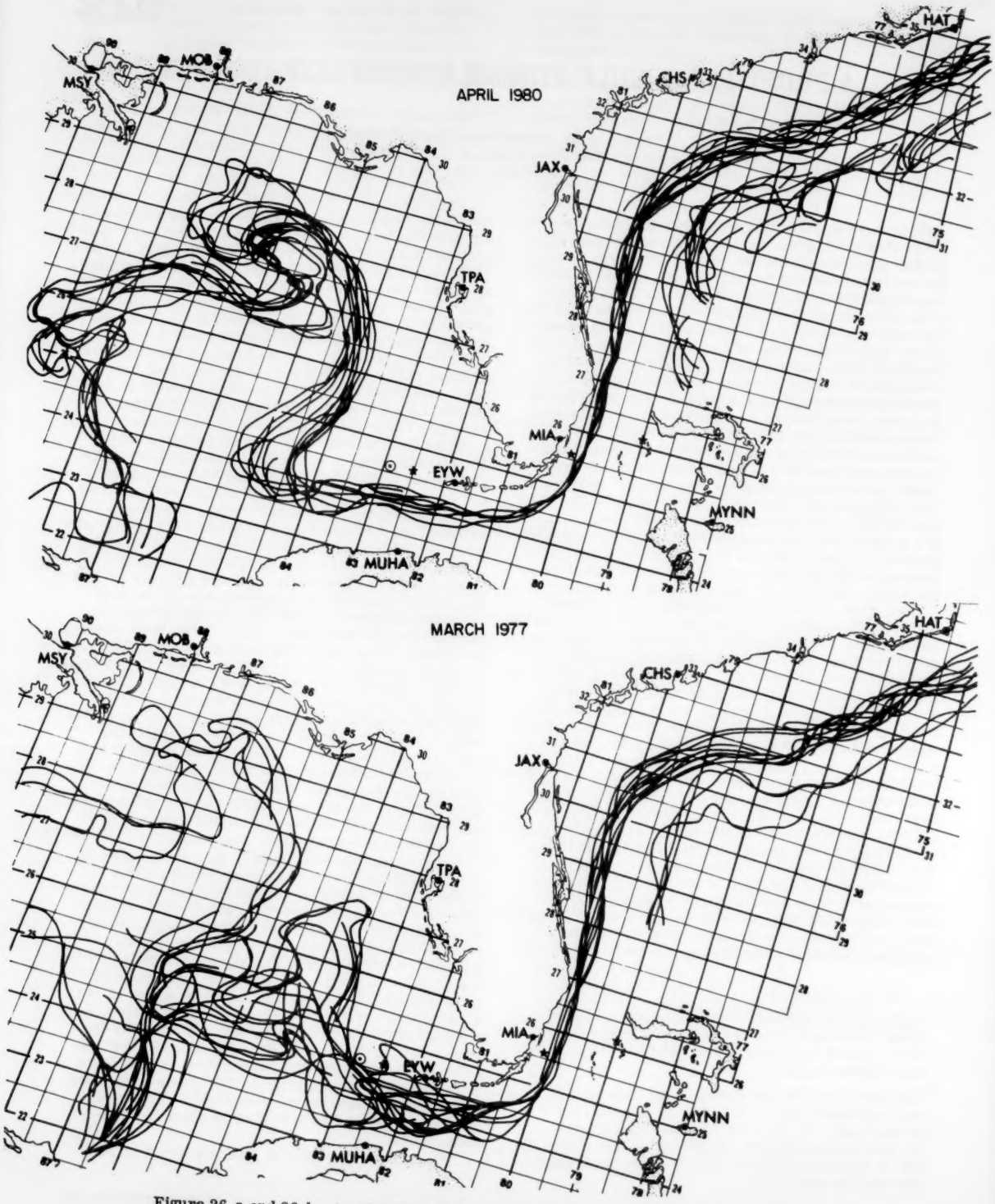

Figure 26. a and 26. b--April 1980 and March 1977 tracings from the original worksheet.

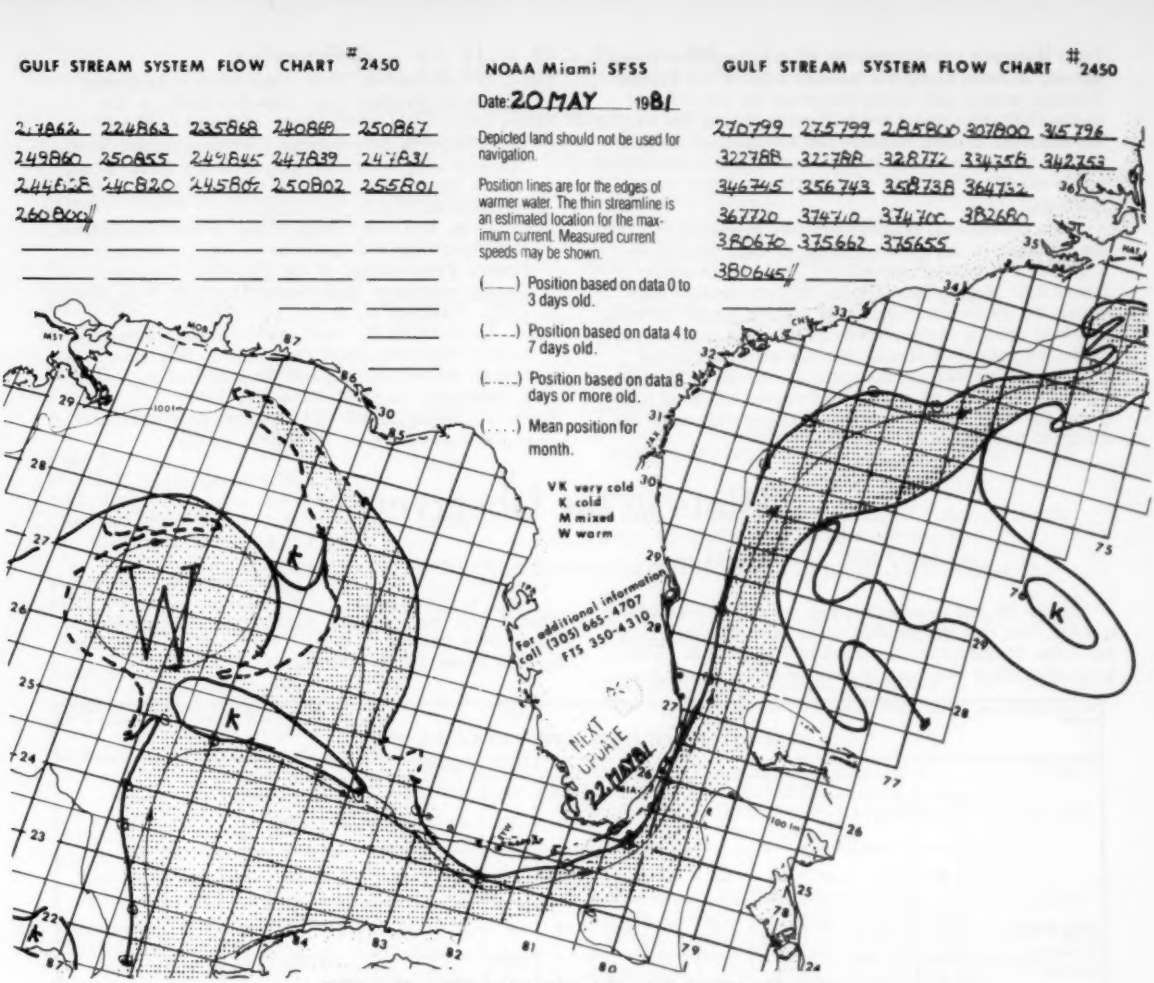

Figure 27.--Operational analysis for May 20, 1981.

month's analysis is shown on figures 14 through 25.[3] Some months contain varying amounts of data in different areas. Short cut-lines separate the sections, and the small numerals along the mean of the inshore and offshore edges indicate the number of years of data used to determine the means. Eleven charts were prepared in this manner; not enough data were available for September to draw a continuous mean position of any useful length. Figures 26.a and 26.b were copied from two of the original work sheets to illustrate how much data were available and how the daily positions varied.

Many of the figures (14, 15, 16, 24, and 25) show extreme locations of the inshore edge of the System very near western Cuba and the Cay Sal bank. In these locales a huge flow of water through such a constriction is not implied, although charter boat captains commonly observe currents of 6 to 7 kn off Cay Sal with such a condition. The evidence indicates that at times when a persistent northerly wind blows across the System, the surface layer can be displaced offshore. At some depth, perhaps only 25 to 30 ft, the current lies much closer to the windward shore. A similar phenomenon has been observed in other areas, although less pronounced. This may be important for larger vessels, depending upon their draft.

The mean and limit charts are probably more useful from the Florida Straits northward to Cape Hatteras than in the Gulf of Mexico. Maul and Baig (1978), in a time-series study using these same data, have shown that most of the frequency of meandering of the Gulf Stream System is of the order of 45 days in the Carolinas region, but is nearly 290 days in the Gulf Mexico. This means that about 32 offshore-onshore meanderings in our analyses of the Carolinas portion of the Gulf Stream System have been included, but only slightly more than 4 north-south meanderings in the Loop Current portion of the System. The analyses in the Gulf are further compromised by the size of the loops formed in this region. They can extend up to 250 mi into the Gulf, from the Yucatan Channel to the Desoto Canyon. By contrast, the size of meanders in other portions of the Gulf Stream System south of

[3]Figures 14 through 25 are located on the center pages of this issue to facilitate removing them for future reference. They should pull off the staples very easily.

Cape Hatteras rarely reaches 60 mi in cross-stream extent, at least along the inshore edge of the System. Finally, means and limits could not be constructed in the Gulf and around South Florida during the warmest summer months because the warming of inshore waters and an increase in total atmospheric moisture make satellite detection of thermal gradients very difficult.

This provisional climatology was prepared to aid the mariner in the absence of up-to-date operational analyses. A typical operational analysis is shown in figure 27. Note especially the thin streamline indicating the estimated location of the maximum current, which is always farther offshore than the inshore edge of the warmer Gulf Stream System water. During those periods when persistent cloud cover or another problem prevents an analysis of recent infrared imagery, the ship captain may use this provisional climatology to advantage.

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Hints to the Observer

WIND-CHILL CHART: KNOTS AND KILOMETERS PER HOUR VERSUS DEGREES CELSIUS

Figure 28 has been published several times previously, but the windspeeds were in miles per hour and the temperature in degrees Fahrenheit. This wind-chill chart has been converted to knots and kilometers per hour versus degrees Celsius making it much more convenient for the mariner. It is Weather Service Form TA B-0-25 (6/76).

WS FORM TA B-0-25 (6-76)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NOAA–NATIONAL WEATHER SERVICE WIND CHILL CHART

EQUIVALENT WIND CHILL TEMPERATURE °C

Wind speeds greater than 70 Km/Sec (35 Knots) have little additional chilling effect.

WIND SPEED Kilometers Per Hour	AIR TEMPERATURE °C												WIND SPEED Knots
70	-7	-14	-20	-27	-33	-40	-46	-52	-59	-65	-72	-78	-85	38
60	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-70	-77	-83	32
50	-6	-12	-18	-25	-31	-37	-43	-49	-56	-62	-68	-74	-80	27
40	-5	-11	-17	-23	-29	-35	-41	-47	-53	-59	-65	-71	-77	22
30	-3	-8	-14	-20	-25	-31	-37	-43	-48	-54	-60	-65	-71	16
20	0	-5	-10	-15	-21	-26	-31	-36	-42	-47	-52	-57	-63	11
10	5	0	-4	-8	-13	-17	-22	-26	-31	-35	-40	-44	-49	5
6	8	4	0	-4	-8	-12	-16	-20	-24	-28	-32	-36	-40	3
	8	4	0	-4	-8	-12	-16	-20	-24	-28	-32	-36	-40	

AIR TEMPERATURE °C

This chart serves only as a guide to the cooling effect of the wind on bare flesh when a person is first exposed. General body cooling and many other factors affect the risk of freezing injury. The equivalent wind chill temperatures used on this chart are based upon a neutral skin temperature of 33° C. With physical exertion, the body heat production rises, perspiration begins, and heat is removed from the body by vaporization. The body also loses heat through conduction to cold surfaces with which it is in contact and in breathing cold air that results in the loss of heat from the lungs. This chart, therefore, does not take into account all possible losses of body heat. It does, however, give a good measure of the convective cooling that is the major source of body heat loss.

Figure 28.--Equivalent wind chill chart for winds in knots and kilometers per hour versus air temperature in °C.

Tips to the Radio Officer

Larry Murphy
National Weather Service, NOAA
Silver Spring, Md.

CORRECTIONS TO WORLDWIDE MARINE WEATHER BROADCASTS (JUNE 1981 EDITION)

Page 7
1-0010 Norfolk, Va., U.S.A. NAM
Add: 0500, 1700 do. IB
at 0630 1900, delete IB.

1-0060 St. John's NFld., Canada VON
Change: 0150 to 0700, 1200 to 1130, 2130 to 2050, 0000 to 0830, and 1330 to 1900.

Page 8
1-0170 Amagansett, N. Y. WSL
Add: frequencies 476 and 4342.6[2]
Change: 13024.5 to 13024.9, F[2] to F, footnote 2 to read "Not used at 1100."

1-0215 Key West, Fla., U.S.A. NAR
Add: Footnote reference 1 to frequency 25590, and footnote 1, "1200-0000 only."

Page 10
1-0385 Change to read:
Thurso, Scotland GXH
Area: Same as NAM 1-0100

0030,1230	3724[1]	W,A
	7504.5	
	12691[2]	
0500,1700	do.	IB
0630,1900	do.	W,F
1000,2300	do.	W,F,IB

1 1900-0800 only
2 0800-1900 only.

Page 11
1-0475 Reykjavik, Iceland NRK
Change: 5167 to 5167[1]
Add: Footnote 1, "1900-0800 only."

Page 17
1-0770 Pt. Reyes, Calif., U.S.A. NMC
Delete: 2100
Change: 12370 to 12730.

1-0780 San Francisco, Calif. KFS
Add: frequency 4358

Page 21
1-1230 Ho Chi Minh-Ville XVS
Delete station.

Page 35
2-0090 St. John's, NFld., Canada VON
Change: 0050 to 0350, 0850 to 1140, 1640 to 1520, 2020 to 1950
Delete: 161.65 MHz(F3)
Add: Continuous 161.65 MHz(F3) S,F,I

Add New Station:
2-0115 Sept-Iles, Que., Canada VCK
Area: (See figure 2)
(a) Anticosti area to Baie Comeau
(b) Grand Banks

0810,1910	2582(A3H)[1]	S,F
1010	2582(A3H)[1]	IB
Continuous	161.65(F3)[1]	S,F,IB
	161.775(F3)[2]	

1 for area (a)
2 for area (b)

Page 37
2-0330 Charleston, S.C., U.S.A. WMB
Change call sign to read NMB

Page 38
2-0430 New Orleans, La., U.S.A. NMG
Add: time 0550 to 2670 KHz broadcast
time 1750 to 157.1 MHz broadcast.

Page 46
2-1160 San Francisco, Calif., U.S.A. NMC
Delete: 1230.

2-1220 King Salmon, Alaska, U.S.A. KCI98
Add: Note: Broadcasts May thru Oct. 15 only.

Page 47
2-1231 Kodiak, Alaska, U.S.A. WBH29
Change: 1100 to 1800
Add: Note: Broadcasts 1 hr earlier during daylight savings time.

Page 55
3-0050 Norfolk, Va., U.S.A. NAM
Add: Footnote reference 1 to call sign
Change frequency and schedule to read: 3357[2], 4975, 8080, 10865, 16410[3], 20015[4], 0000 Schedule
1 U.S. Navy Fleet Broadcast -- NFAX
2 1600-1400 only
3 1400-0000 only
4 0600-0200 only

Page 57
3-0160 Rota, Spain AOK
Delete: All frequencies and time 1200
Add: Frequencies 7417 and 9875.

Page 62
3-0320 San Francisco, Calif., U.S.A. NMC
Change to read:
Area:
(A) 40°N-52°N, East of 135°W
(B) 28°N-40°N, East of 132°W
(C) 30°N-60°N, East of 160°E
(D) 20°N-30°N, East of 160°W
Frequencies (kHz)
0100-1500: 4344.1, 8680.1, 12728.1, 17149.3
1700-2300: 8680.1, 12728.1, 17149.3
0100 A Surface Prognosis VT 12 Z
0110 B Surface Prognosis VT 12 Z
0120 C Surface Prognosis VT 00 Z

0130 D Surface Prognosis VT 00 Z
0300 A Ocean Thermal Analysis
0310 B Ocean Thermal Analysis
0400 C 00Z Surface Analysis
0410 C 72 Hr. Outlook VT 12 Z
0530 C 00? Surface Analysis
0540 C 72Hr. Outlook VT 12Z
01500 Test Pattern
1510 A Ocean Thermal Analysis
1520 B Ocean Thermal Analysis
1700 C 12Z Surface Analysis
1710 D 12Z Surface Analysis
2000 C 12Z Surface Analysis
2010 D 12Z Surface Analysis
2020 C Ocean Thermal Analysis
2030 Schedule
2200 C 18Z Surface Analysis
2210 D 18Z Surface Analysis
0550,0600, Experimental Fisheries
0610, 2300, products from
2310,2320 NASA/JPL

Page 63
3-0360 Guam, Marianas Is. NPN
Add: Frequencies 3377.5, 10966, and 22865
Add: Footnote reference 2 to frequencies 7645, 22865
Footnote 2, "On call."
Add: Footnote reference 3 to frequency 18620
Footnote 3, "0100-1300 only."

Page 70
Add two new stations as follows:

4-0005 Halifax, N.S., Canada CFH
Area:
(1) North Atlantic
(2) East and south coasts of Newfoundland, Gulf of St. Lawrence and Nova Scotia
Frequency (kHz): 4269 (2300-0700), 6328, 9888, 13508 (0900-2000), 122.5 MHz
0100,0630 Warnings and Forecasts
1400,1922 for Area 2
0333,1033 Warnings and Foreaasts
1630,2340 for Area 1.

4-0020 Boston, Mass., U.S.A. NMF
Area: North Atlantic west of 35°W including Caribbean Sea and Gulf of Mexico
Frequency (kHz): 8490, 13020, 16968.8
0200,1700 Warnings and Forecasts

Page 72
Add new station:
4-0120 San Francisco, Calif., U.S.A. NMC
Area: Pacific Ocean between 10°S-40°N, 78°W-160°W; North Pacific Ocean; Offshore waters; Cape Flattery to Guadalupe Island.
Frequency (kHz): 8714.5, 17207.0
0000,1800 Forecast and Warnings

ACKNOWLEDGMENTS

Our thanks to Officers L.E. Welton on the SS SAM HOUSTON and G.L. Hale on MV TAMARA GUILDEN for their information leading to some of the above changes.

Marine Observations Program

J.W. Nickerson
National Weather Service, NOAA
Silver Spring, Md.

In these days of low buying power, everyone wants to get the maximum bang out of each buck. The same principle applies to weather observations and weather forecasts. Aboard ship you use your time and expertise making weather observations. How much bang do you get back out of the forecast?

I recently got an earful from a number one on his ship in Baltimore Harbor who thought he was getting short changed. For one thing he was confused about reporting the weather as soon after the synoptic hour as possible. Synoptic, in this case, refers to observing the weather at one time all over the world. It has to be done this way because the atmosphere and the weather in it are in constant motion.

For observations to be useful, they must be radioed back to a shore radio station where they are relayed rapidly to a Forecast Office. This was not well understood either. Weather information is actually very perishable. To get the maximum bang out of your observation it will have to arrive at the National Meteorological Center (NMC) no later than 1 hr 20 min after observation time. This guarantees its full usage. It will be sent with other early observations to the Weather Service Forecast Office (WSFO) for plotting and analysis. Meanwhile, at NMC data from your observation will be used in the computer to produce guidance products. When these are ready they are relayed to the WSFO, where the weather forecaster uses the guidance products, which contain all the inputs from your observation, and makes a forecast based on the plotted and analyzed weather map. The observation from your ship would also be plotted if it arrives in time. However, for the observation to reach NMC in time for all these good things to occur, the weather report must leave the ship within 1 hr after the observation.

Well, the number one didn't understand that time was so critical. About that time the radio officer came into the wardroom. He didn't know the weather report should get off the ship in the first hour either. He didn't see it as a problem. Of course, they would have to clear it with the captain. They were also sure he didn't understand the need to move the weather messages quickly. In fact, there are probably a lot of masters, mates, and radio officers who do not understand this situation.

In the study we did of the May 1981 weather reports received by radio it appears there are many

Table 2.--Hours after synoptic time that observations were received at NMC for May 1981

Synoptic Hour	0 - 1	1 - 2	2 - 3	3 - 6	6+	Totals
0000Z	8,911	6,958	2,025	1,891	2,130	21,915
0600Z	8,724	6,291	2,224	2,673	2,834	22,746
1200Z	8,922	7,003	3,053	3,052	624	22,654
1800Z	7,311	6,371	2,174	2,196	2,018	20,070
Total No. Observa.	33,868	26,623	9,476	9,812	7,606	87,385

who don't realize the weather report needs to be off the ship within 1 hr after the synoptic time. Table 2 shows the results of the study.

Let me emphasize though that weather reports received after 1 hr 20 min are used both at NMC and at the forecast offices. They are very helpful; so if you cannot sent the report within 1 hr of synoptic time (0000, 0600, 1200, 1800 GMT), send it as soon as you can. However, your data only influences the current forecast when it goes out within the first hour. Observations received after the forecast map go onto the map to fine tune fronts and weather situations for the next forecast. Nothing is wasted, you just don't get the same bang for the work you do.

Hurricane Alley

Dick DeAngelis
Environmental Data and Information Service, NOAA
Washington, D.C.

GLOBAL TROPICAL CYCLONES MAY AND JUNE 1981

As last year eight tropical cyclones developed during this period; however, they were not all confined to the North Pacific. The North Atlantic spawned two tropical storms and one popped up in the South Indian Ocean. A hurricane and a tropical storm roamed the eastern North Pacific waters, while two typhoons and a hurricane came to life in the west. Descriptions of these tropical cyclones can be found in the appropriate Rough Logs except for the South Indian Ocean storm, which follows.

Paddy was an unusual May South Indian Ocean tropical cyclone. He was only the fourth since 1965. He developed slowly southwest of the Cocos Islands (fig. 29) late in the month. Moving along the western periphery of a high-pressure ridge, Paddy never developed beyond minimal tropical-storm strength. He dissipated on the 29th due to strong vertical wind shear and upper level flow.

TROPICAL CYCLONE WATCH - 1981

The tropical cyclones that have developed through September 1981 appear in table 3. This list is preliminary.

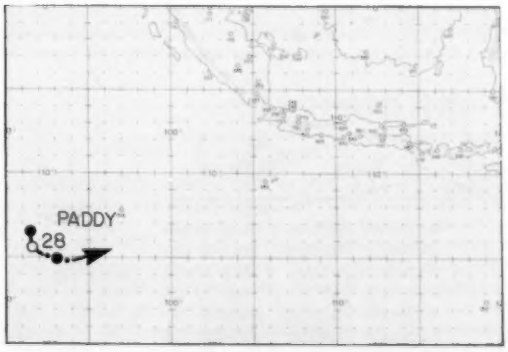


Figure 29.--South Indian Ocean tropical cyclones, May 1981.

Table 3.--World tropical cyclone watch, 1981

South Indian Ocean			
Florine	01-81	H	Jan.
	04-81	T	Jan.
Helyette	06-81	T	Jan.
	10-81	T	Feb.
Johanne	16-81	H	March
Olga	22-81	H	April
Lisa	23-81	T	April
Paddy	24-81	T	May

Western North Pacific			
Freda		H	March
Gerald		T	April
Holly	TC-3	T	April
Ike	TC-4	T	June
June	TC-5	H	June
Kelly	TC-6	H	June
Lynn	TC-7	T	July
Maury	TC-8	H	July
Nina	TC-9	T	July
Ogden	TC-10	T	July
Phyllis	TC-12	T	Aug.
Roy	TC-13	T	Aug.
Susan	TC-14	T	Aug.
Thad	TC-15	H	Aug.
Vanessa	TC-16	T	Aug.
Warren	TC-17	T	Aug.
Agnes	TC-18	H	Aug.
Bill	TC-19	H	Sept.
Clara	TC-20	H	Sept.
Doyle	TC-21	H	Sept.

North Atlantic			
Arlene		T	May
Bret		T	June
Cindy		T	Aug.
Dennis		H	Aug.
Emily		H	Sept.
Floyd		H	Sept.
Gert		H	Sept.
Harvey		H	Sept.

Australia-South Pacific			
Arthur	02-81	T	Jan.
Mabel	03-81	H	Jan.
	05-81	H	Jan.
Betsy	07-81	T	Jan.
Cliff	08-81	H	Jan.
Eddie	09-81	T	Feb.
Daman	11-81	T	Feb.
	12-81	T	Feb.
Neil	13-81	H	Feb.
Freda	14-81	H	Feb.
	15-81	T	March
Max	17-81	H	March
	18-81	T	March
Fran	19-81	T	March
	20-81	T	March
Klara	21-81	T	April

Eastern North Pacific			
Adrian	TD-1	T	May
Beatrix	TD-2	H	June
Calvin	TD-3	T	July
Dora	TD-4	H	July
Eugene	TD-5	T	July
Fernanda	TD-7	H	Aug.
Greg	TD-8	T	Aug.
Hilary	TD-10	T	Aug.
Irwin	TD-11	T	Aug.
Jova	TD-12	H	Sept.
Knut	TD-13	T	Sept.

GLOBAL TROPICAL CYCLONES MAY AND JUNE 1980

The North Pacific spawned all eight tropical cyclones that developed during this 2-mo period. Four of these storms reached hurricane or typhoon strength. Activity was divided equally between the 2 mo, but the western Pacific was responsible for five storms; however, only one of these came to life in June. Table 4 provides a summary of the activity which is plotted in figure 30.

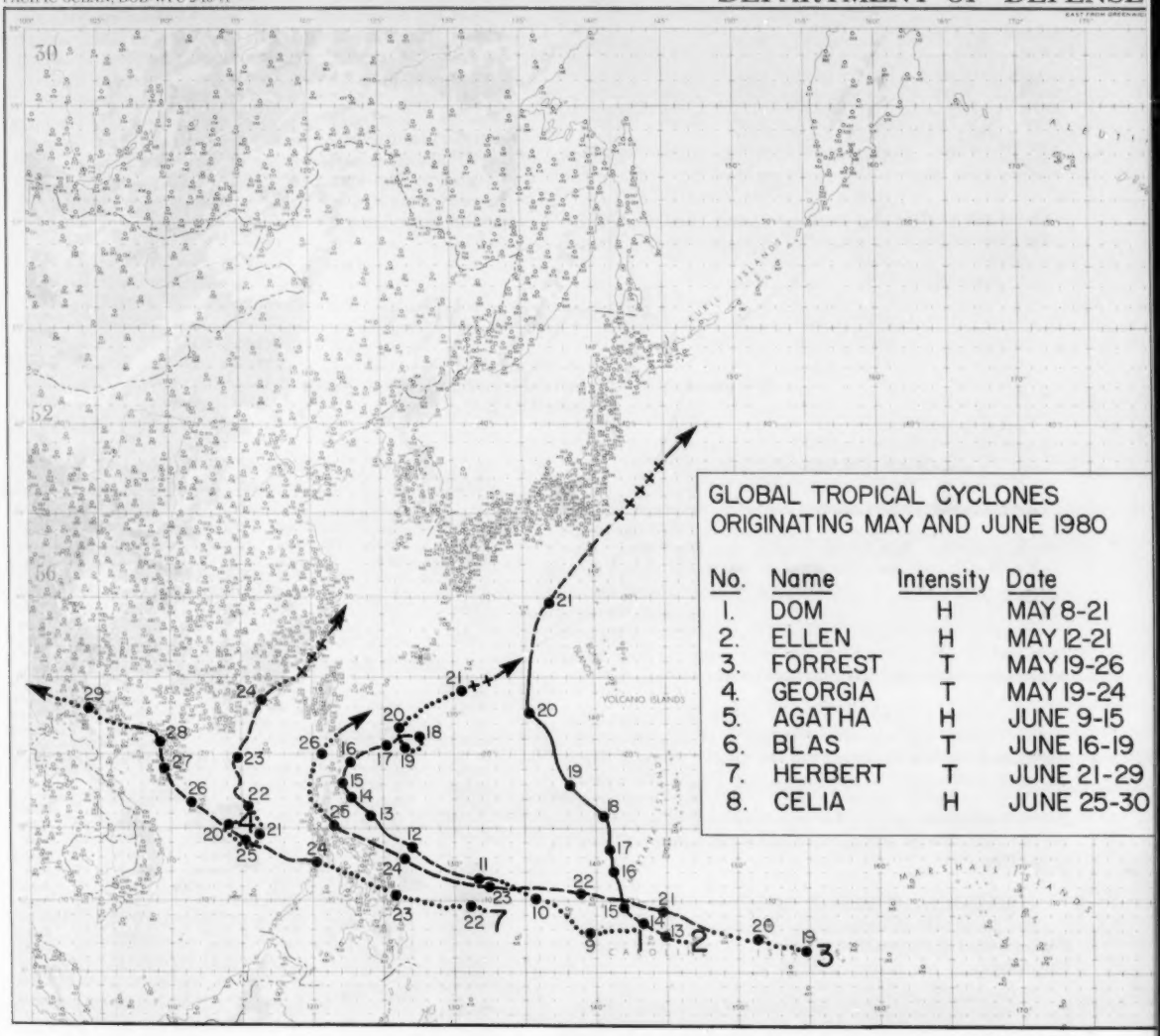
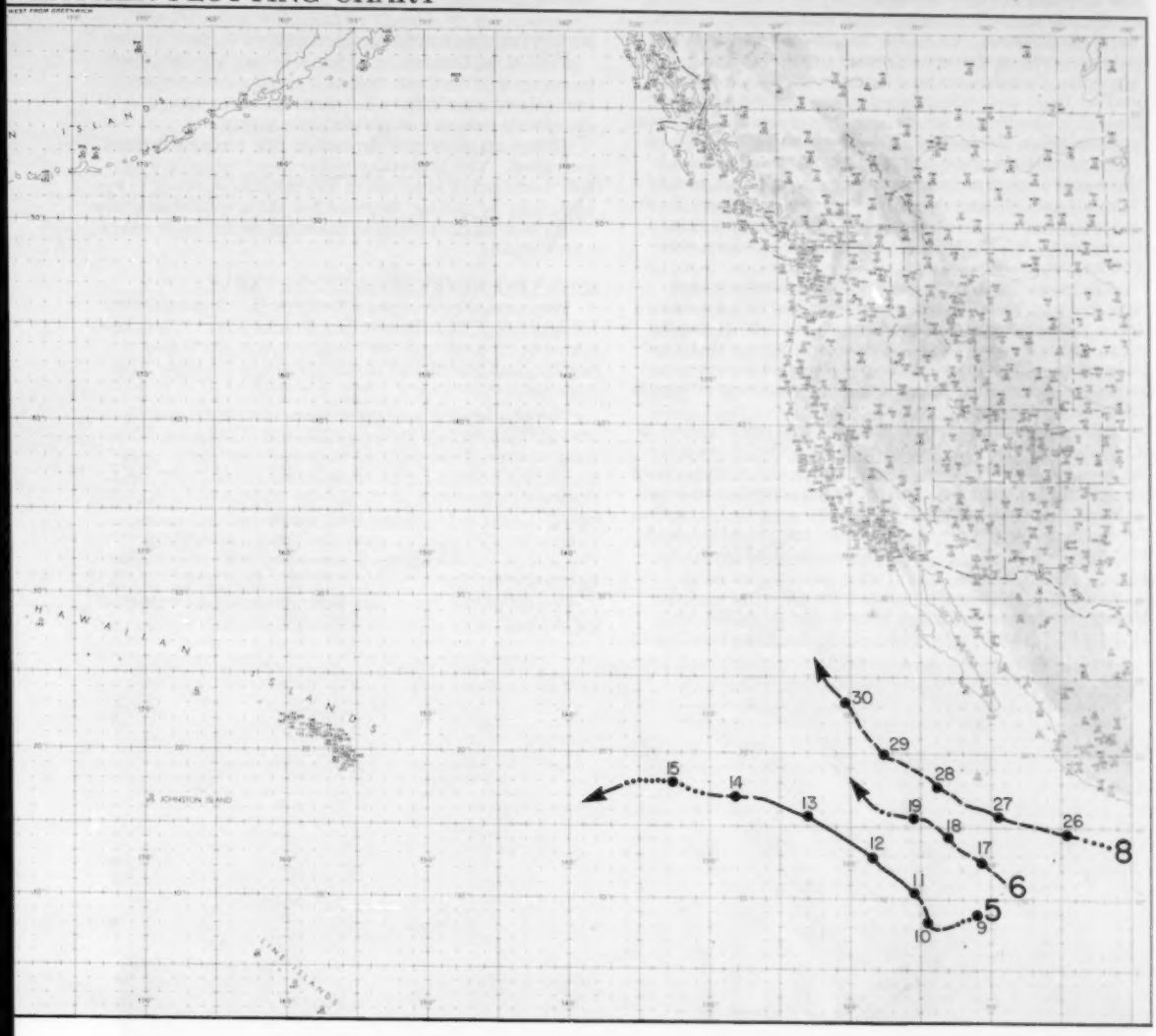


Figure 30.--Global tropical cyclones, May and June 1980.

Table 4--Global tropical cyclone summary, May and June 1980

No.	Name	Peak Intensity	Est. max. wind(kn)	Est. min. sea-level pressure (kn)	Basin	Dates
1	Dom	H	90	956	W. North Pacific	May 8-21
2	Ellen	H	110	931	W. North Pacific	May 12-21
3	Forrest	T	55	990	W. North Pacific	May 19-26
4	Georgia	T	55	985	W. North Pacific	May 19-24
5	Agatha	H	100	--	E. North Pacific	June 9-15
6	Blas	T	50	--	E. North Pacific	June 16-19
7	Herbert	T	50	980	W. North Pacific	June 21-29
8	Celia	H	65	--	E. North Pacific	June 25-30

WEATHER PLOTTING CHART



On the Editor's Desk

WEATHERSHIP ERA ENDS IN PACIFIC

When the Canadian Coast Guard ship QUADRA left Ocean Station Papa last June over 3 decades of weathership service in the eastern North Pacific ended. The QUADRA and sistership VANCOUVER regularly supplied weather information from the ocean station 860 mi west of Vancouver, British Columbia. In addition to their weather collection duties, the two ships had been relaying AMVER message traffic since 1967 when they first saw duty on Ocean Station Papa.

Satellites cannot replace the weatherships' extensive research programs and detailed, precise observations, but because of improving satellite technology and increasing operating costs, Canada's Atmospheric Environment Service decided to retire the ships and install a new satellite imagery receiving station in Vancouver.

The events of World War II and the expansion of commercial passenger aviation first brought about the need for more weather information, particularly high-altitude data. In 1946, several countries interested in a comprehensive meteorological service met to plan

and allocate weather stations.

Canada agreed to operate two stations jointly with the United States, one in the Pacific and one in the Atlantic. When the arrangement proved unsatisfactory, however, Canada assumed complete control of Ocean Station Papa and relinquished control of the Atlantic Station to the United States. U.S. services to all ocean stations were phased out several years ago.

Ocean Station Papa at 50°N, 145°W, was in one of the world's most notorious and trying weather areas. Virtually all storms that affect the west coast of North America traverse that area. On its first voyage in December 1967 the QUADRA encountered winds over 100 kn and 70-ft seas.

The most distinctive feature of the weatherships was their balloon tracking radar system which could track meteorological balloons up to 100,000 ft and detect storms 200 mi away. The balloons provided wind data in the upper atmosphere, while their instrument packages automatically radioed temperature and humidity back to the ship.

Crewmembers at Ocean Station Papa participated in a number of activities while off duty. The ships were equipped with an amateur radio room, and movies were shown twice a week. Other crewmen fished, and many enjoyed a game of cards. The hobby shop had facilities for wood and leather work, rug hooking, painting, and building ship models. Books were supplied by the Victoria Public Library.

The era of weathership data collection has ended. Ninety days after their last patrols the QUADRA and VANCOUVER will be turned over to the Canadian Crown Assets Disposal for sale.

NEW YORK HARBOR TIDAL GAUGES

New York Governor Hugh Carey has signed a bill to set up in New York harbor a computerized system that allows subscribers to get accurate readings on exact water depths at several key points.

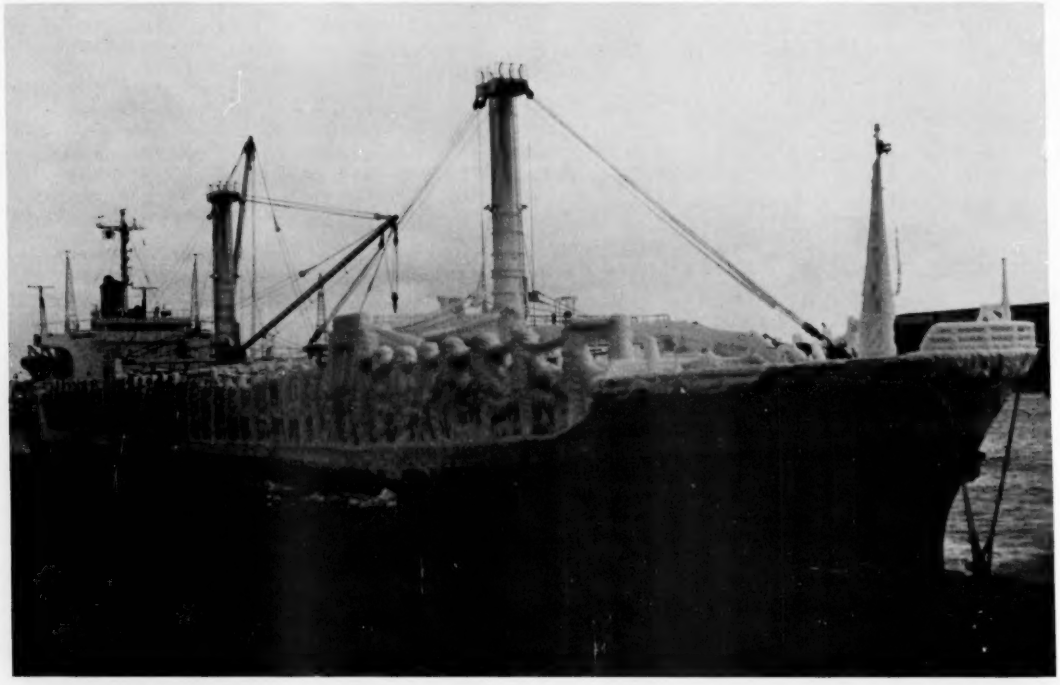
Ships' masters now depend on tide tables based on averages. The real-time water-level telemetry system could bring in an extra $64 million worth of cargo each year by cutting the need for ships to unload some cargo onto barges because masters do not know exact water depths.

ICING ON SINCERE NO. 5

This photograph of the SINCERE No. 5 coated with ice was taken by Iwakur-Gumi Tomakoma. It was obtained by Don Olson, Port Meteorological Officer in Seattle, and forwarded to the Mariners Weather Log (fig. 30).

The photograph was taken on arrival in Japan following their voyage from the Pacific Northwest. The icing occurred the night of February 14, 1980, near the Kurile Islands. The temperature was -17°C, the wind west at force 6 to 7, and the weather was heavy snow. Captain Lu Hsing-Hwa estimated that there were some 500 tons of snow and ice accumulation. The Front Cover shows the weather pattern for 1200 February 14, 1980.

The SINCERE No. 5 has been an excellent reporter for the past 5 yr while on the North Pacific route.



EDITORIAL FROM THE MARINE OBSERVER

The following editorial by Captain C.R. Downes was published in the January 1981 issue of The Marine Observer. I think it is outstanding and it is worth repeating here. The last sentence of the second to last paragraph is especially significant. Satellites and buoys can only supplement, not replace, ship observations.

"I have known the sea too long to believe in its respect for decency."

Joseph Conrad (1857-1924)

"Joseph Conrad was born in the Ukraine and first went to sea in the French merchant service in 1875. Rather strangely, he served first as an Apprentice and then as a Steward before signing on as a deckhand in a British merchant ship in 1878. Thereafter he sailed on deck in the wool clippers on the London to Sydney trade for a number of years during which he passed his 2nd Mate's examination in 1880, obtained his Mate's Certificate in 1884 and his Master's in 1886. Conrad spent a total of 16 years in the British Merchant Navy before 'swallowing the anchor' and taking up a literary career. In literature, Conrad is admired for his descriptions of the dangers of life at sea of which he held not the romantic but the mariner's workmanlike view.

"In the hard days of sail during the latter part of the nineteenth century, it certainly would not have taken Conrad very long to lose any preconceived thoughts of the sea being a kindly environment and, no doubt, he very soon built up a healthy respect for the vagaries of the ocean. This is true of every mariner. In the writer's experience, long before embarking on a seafaring career, recollections of a younger brother being swept off a rock by a rouge wave whilst on a sea-side holiday are still vivid. Fortunately, help was at hand and no harm done. Later, whilst undergoing training, a fellow Cadet slipped and fell overboard into a wind-against-tide sea and, despite being a strong swimmer, was tragically drowned.

"In September each year a conference is held by the International Union of Marine Insurers. At the 1979 conference, held in Edinburgh, warnings were given of the upward trend in numbers of marine casualties which have proved dismally true. The latest conference, held in Seattle, met against a background of the worst peacetime losses in Merchant Shipping for many years. A study of the Casualty Returns issued by the Liverpool Underwriters' Association for the past 4 years reveals that the total losses, including constructive total losses, of ships exceeding 500 gross tons posted in their Loss Book in 1976 was 208--- the corresponding figure for 1979 was 279 ships. Of particular interest, in the context of this journal, is the disturbing increase in the number of ships the loss of which is directly attributable to weather, the figures being 36 for 1976 and 59 for 1979. These figures do not take into account those losses due to such as stranding and collision in which weather was only a contributory factor. In the years 1976 to 1978 fires and explosions accounted for the greatest number of ship losses followed by strandings and then weather. In 1979 the order changed and losses directly due to weather became second. This trend has been sustained in 1980. In the months January to June, out of 120 total losses no less than 25 were directly attributable to weather and only 17 due to stranding.

"As this Editorial is being compiled, news has come in of the tragic loss, apparently with all hands, of the DERBYSHIRE some 650 nautical miles south of Tokyo Bay. This 169,044 tonnes deadweight ship was on passage from Seven Islands in Canada to Kawasaki in Japan laden with 158,000 tonnes of iron ore. She was a well-maintained and operated ship, fitted with modern navigational aids and owned by a reputable, long-established British shipping company with an excellent safety record. She is probably the biggest single British flag loss in maritime history and her disappearance could be one of the largest unsolved mysteries of the sea. In her last report by radio, the DERBYSHIRE was hove-to in heavy seas in close proximity to typhoon Orchid. Possibly we shall never know exactly what caused her disappearance but if it was not directly attributable to weather then it appears likely that it was a contributing cause in the tragic loss of life.

"If there is one lesson which can be learned from the above figures, it is that it does not do to take chances, for the sea is without mercy and never forgives. As Max Pemberton wrote: 'Study her a thousand years and she's not a day older--- say that you've mastered her and she'll beat the life out of you, for she owns no master.'

"From time to time in this journal, reference has been made to the fact that no matter how much the improvement in the design, machinery and navigational equipment of ships, the weather continues to play a large part in their safety as well as in their economic operation. One purpose of the Meteorological Office, indeed the purpose for which it was originally constituted over 120 years ago, is to warn shipping of gales and storms. For very good reasons, the Marine Superintendent of the Meteorological Office attends the Safety of Navigation Committee which meets under the auspices of the Department of Trade and often represents the World Meteorological Organization at the Inter-Governmental Maritime Consultative Organization's meetings and conferences. The Editorial to this journal a year ago quoted a letter written by the Marine Superintendent to all Masters of ships in the Voluntary Observing Fleet which stated that a new Meteorological Code is to be introduced in January 1982. Elsewhere in this edition are some introductory notes to this new Code. One of the main reasons for the change is to accelerate the exchange of data between meteorological centres and this should ensure that forecasts for shipping are improved. However, it it well to remember that the standard of our work and the quality of our services to shipping are still, as they always have been, directly proportional to the number of voluntary meteorological observations received from ships and it is only by continuance of our mutual efforts that we can ever hope to resolve some of the questions on the safety of life at sea.

"May 1981 see an improvement in the world shipping industry, a decrease in the number of ships damaged or lost in heavy weather and good fortune to all our readers whether ashore or afloat."

SAILS MAKE A COMEBACK ON JAPANESE SHIP

Sailing ships may once again be a common sight on the high seas if a vessel launched by a Japanese firm last year proves successful. The SHINAITOKU MARU carries thousands of gallons of crude oil below decks and two folding plastic sails above.

The 699-ton tanker was developed jointly by Nippon Kokan and the Japan Marine Machinery Development Association. Officials say that, although the cost of the vessel was more than 15 percent higher than that of a regular tanker of the same class, the ship uses about 50 percent less energy because of the sails and improvements in the hull design, propeller, main engine, generator, and waste gas recycling.

When the wind is right a computer turns off the ship's main diesel engine and maneuvers the sails to keep them set constantly at the optimum angle for best use of the wind. The two sails have an area of about 200 m^2 (2,150 ft^2). Maximum speed of the ship is 12 kn. It carries a crew of 10. No extra crewmen are required to handle the sails.

The U.S. Maritime Administration recently completed a study in which it concluded that sail-assisted ships of up to 40,000 tons could achieve fuel savings of between 15 and 25 percent over conventional ships. The report said sails would give ships a competitive advantage, particularly on the North Atlantic and North Pacific routes where windspeeds are higher.

Most ships to be built in the next decade could benefit from sail propulsion, according to the study. Small and medium tankers such as SHINAITOKU MARU are the best candidates as sails cause little or no disruption to the normal operation of the ship.

According to the report, a 20,000-ton ship could maintain an average speed of between 10 and 20 kn and still operate more economically than conventional motor ships even with the windspeeds as low as 10 kn.

As with the SHINAITOKU MARU, the U.S. study concluded that the cost of the sails would be offset by the savings in fuel and a reduction in engine size. Any running cost advantages are naturally expected to increase in the event of a future fuel price rise which would produce more interest in the refined design of sail-powered vessels.

EPIRB DOES NOT GUARANTEE RESCUE

Having an emergency position indicating radio beacon (EPIRB) aboard does not guarantee rescue. Someone has to receive the signal, report it, and someone has to come to the rescue. The class A EPIRB beams a steady signal on 121.5 and 243 MHz, both aircraft distress frequencies. Therefore, a listening aircraft has to fly within range and be monitoring one of these frequencies. Not all aircraft monitor these frequencies and not all of the time. They are designed to operate at least 48 hr floating in the water and are intended for use at least 20 mi offshore. The maximum range is 200 mi if the aircraft is at 40,000 ft or above. U.S. military and Coast Guard aircraft and those of many foreign countries monitor 243 MHz. Aircraft on long overwater flights usually monitor, but only while some distance offshore. Large Coast Guard cutters also monitor, but their reception range is limited due to antenna elevation.

The class A type is designed to float off a sinking ship and automatically turn on. A class B type must be manually released and activated.

A new class C type is available and designed for use within 20 mi of shore where most boating emergencies occur. It transmits an alerting signal on VHF/FM channel 16 and alternately a homing signal on channel 15. Its signal can be received by other marine vessels, Coast Guard stations, and rescue craft, but is also line-of-sight reception. The signal still must be received and action taken to initiate rescue operations.

WAVE-WARNING SYSTEM PONDERED IN NORWAY

The Norwegian Meteorological Institute is considering the introduction of a system to give early warning of dangerous wave formations along the Norwegian coast.

Norwegian officials said the system would be feasible and that the warnings would probably be worked out on the basis of long-distance measurement of seas and currents, aerial observation, inspection and measurements at buoys.

Most vessels are well equipped to use a system of this type. More and more ships have, in addition to radio, facsimile equipment on board. This can be used for the reception of weather charts, where such things as wave warnings could be plotted.

The question of whether to establish a wave-warning system along the coast arose after the completion of a 3-yr research project at the Norwegian Hydrodynamics Laboratories in Trondheim. The project showed that there are 24 areas along the Norwegian coast that are particularly dangerous to vessels. A number of ships have foundered in these waters over the years, and several ships have sunk after being broken by huge waves.

If a wave-warning system is established, it will be prepared jointly by the weather-forecasting authorities in Oslo, Bergen, and Troms.

POET MAY HAVE SUNK IN STORMY OCEAN WITHOUT PRIOR DAMAGE OR DEFECT

The disappearance of the POET with the loss of 34 crewmen in October 1980 may have resulted from an encounter with a storm that suddenly rolled the ship over without it having sustained prior damage, according to the National Transportation Safety Board.

The Board was unable to determine the probable cause of the POET's loss, since no distress signal was heard and no trace of the ship or crew was found. However, the Board said, "based on assumed sea conditions, ship speed, and ship heading, calculations indicate that the POET may have capsized suddenly due to synchronous rolling."

Synchronous rolling is a condition in which the frequency and height of succeeding waves, combined with the direction of their force upon a ship, can lead to increasingly deep rolls and an eventual capsizing.

The freighter, loaded with corn, left port October 24, 1980, and the following day would have encountered severe storm conditions, possibly resulting in waves approaching 30 ft and winds over 60 kn, according to the Board's review of weather data and reports from other vessels in the area.

Assuming the course the captain would have taken between Delaware Bay and the Straits of Gibraltar on his way to Egypt and a speed of 15 kn, the Board calculated that the POET would have encountered stormy seas from the early hours of October 25 through the afternoon of the 26th, and concluded that the POET would have adjusted course to the south to ease the effect of the seas. As the winds and waves shifted to the southwest on the 26th, the master would have resumed an easterly heading, exposing the ship to quartering seas. The Safety Board believes that capsizing in beam or quartering seas on October 26 is the most likely explanation for the sudden loss of the POET.

"Beam" seas refers to waves striking perpendicular to the ship's direction, while "quartering" seas approach from the stern quarter. In both cases, the ship could have capsized and sunk within a matter of minutes.

The POET was equipped with all required radio apparatus, including a main transmitter, high-frequency transmitter, emergency transmitter, lifeboat radios and an EPIRB, which is an emergency position-indicating radio beacon activated when immersed in salt water. It is unlikely that all of the POET's radio equipment failed to operate simultaneously. The Board noted that if the ship's power failed, the POET had batteries for the emergency transmitter and the lifeboat radios could have been hand-cranked.

If the radio equipment was struck by lightning, the emergency transmitter should still have functioned because it had its own antenna and a separate unit. An independent radio technician testified that the equipment was in good condition and all of it was functioning when the POET's voyage began.

The Board report said the ship was equipped with an emergency generator powerful enough to operate the steering gear or to be used to restart the main plant, as well as to provide emergency lighting and power for the ship's radios.

Lifesaving equipment consisted of two 40-person lifeboats, two 20-person liferafts, 18 ring lifebuoys with lights, and 47 lifejackets.

In reviewing the Coast Guard search operations the Safety Board said the air search was "extensive and exhaustive considering the limited information about the position of the POET and the lack of a distress signal." The search was concentrated along the first 72 hr of the POET's estimated trackline, but covered the entire projected route to Gibraltar.

The Safety Board made 11 recommendations to four government agencies and another 7 recommendations to other organizations, including one to the POET's owner to instruct the masters of all its ships of the company policy to report the ship's position every 48 hr.

EAST COAST FISHERMEN ASKED TO SEND WEATHER REPORTS

A marine weather reporting system for the East Coast involving the commercial fishing fleet and the National Weather Service is being coordinated by the University of Rhode Island Marine Advisory Service (URI MAS).

Beginning in August local commercial fishermen were asked to radio observations twice a day to the Point Judith Fishermen's Cooperative in Galilee, R.I. The weather observations are then telecopied to the National Weather Service in Boston and used in producing its marine weather condition broadcasts and forecasts.

Fishermen are asked to send reports over frequency 4126.4 KHz to the Point Judith Coop as close

to 1200 and 1700 GMT as possible. The reports should consist of their assessments of windspeed and direction, wave and swell height, sea-surface and air temperatures, weather, visibility, and any significant weather events such as gusty winds, freezing spray, or rapid barometer changes.

The URI MAS has designed a columnar format for reporting the observstions, so that the procedure requires a minimum of time. Copies can be obtained by writing MAS at the URI Narragansett Bay Campus, Narragansett, R.I. 02882 or calling 401-792-6211.

On completion of the midday reports, the National Weather Service will transmit back to the Coop a 36-hr prognostic chart which will be posted on the Coop's bulletin board and broadcast over radio. The information the fishermen send in will provide needed observations to the National Weather Service for areas off the coast from where few weather reports are being transmitted. The principle behind the program is the highly successful aircraft reporting system, where pilots file regular weather observations.

Hopefully, the service will expand to include observations from fishermen as far south as North Carolina, since much of New England's marine weather comes from that region. Also, observations are welcome from operators of other commerçial or pleasure craft.

The venture with the weather service is only one part of URI's effort in assisting improvements of marine weather information. Currently the remote sensing facility at the URI Graduate School of Oceanography and the Jet Propulsion Laboratory in California are working to arrange transmissions of weather information from the U.S. Navy's weather system. Already servicing fishermen in the Pacific, the Satellite Data Distribution System collects information from satellites, weather buoys, ships, and other sources, analyzes it, and then transmits radio facsimiles of weather charts in formats useful to fishing operations.

COMPUTERIZED SHIPBOARD NAVIGATION SYSTEM

A computerized shipboard navigation system developed by the John Hopkins University, Applied Physics Laboratory, will give a ship's watch an evolving real-time graphic display of the vessel's position in a river channel or harbor.

The navigation aid, called PILOT for Precision Intracoastal Loran Translocation, was developed for the U.S. Coast Guard and is now undergoing engineering tests aboard U.S. and Canadian ships in the Great Lakes. The unit is about the size of a portable television set and can be installed aboard ship in about 1 hr.

The system is likened to instrument landing for aircraft. Employing PILOT, a ship watch officer can see on the display screen a harbor chart with his vessel, drawn to scale, superimposed on the chart. Also displayed on the screen is the vessel's speed, bearing, time-to-go, and distance to the next predefined navigation point. The navigation charts continuously evolve as the vessel progresses in the harbor or river. A special cross-track display is available to aid the ship's watch in maintaining position with respect to the center of the channel.

The PILOT terminal could be an invaluable aid to a ship trying to navigate in a narrow channel in fog or a snowstorm, even if ice had dislocated or obscured the channel markers.

PILOT, however, is not for collision avoidance any more than instrument landing offers such protection for aircraft. The PILOT system is an all-weather system deriving position information from Coast Guard operated Loran-C transmitting stations.

PILOT is a data processor into which a magnetic cartridge has been inserted, containing charts of the harbor, channel or river to be navigated and the route to be covered. It is designed specifically for ore carriers along the 65 mi stretch of the St. Marys River from Whitefish Bay in Lake Superior to De Tour Passage in Lake Huron. Throughout much of the river, these carriers, some 1,000 ft long with a 105-ft beam, are confined to dredged channels no wider than 300 ft. During warm, clear weather the Coast Guard's buoys, day beacons, visual ranges, and radio vessel reporting are adequate, but during winter additional navigation aids are needed to compensate for poor visibility, buoys removed or obscured by ice ridges.

The PILOT system demonstrates that Loran signals can be successfully used to pilot large ships in harbors and rivers without significantly increasing the workload of the watch officer, and that the system could be mass produced by industry for an affordable price.

A commercially available computer graphics terminal was selected as the nucleus of the PILOT system. Significant hardware modifications were required, but most are of the plug-in or bolt-on type and do not change the basic terminal. The Loran receiver currently used is an unmodified commercial item.

During the past year a PILOT terminal has undergone a series of tests aboard the Coast Guard cutter KATMAI BAY. Encouraged with the success of these tests, PILOT terminals have been installed aboard the Canadian Coast Guard ship VERENDRYE and three Great Lakes commercial ore carriers.

ART COOPERMAN RETIRES

Art Cooperman, the "man behind the scene" of the Mariners Weather Log for the past 25 yr, retired in September. Art has been associated with the Log since its inception in 1957. More than anyone he has been directly responsible for its success and the advancement of marine climatology in general (fig. 31).

Art graduated from the United States Merchant Marine Academy at Kings Point in 1944. From 1944 to 1948 he sailed the stormy North Atlantic as second and third mate aboard merchant vessels. After graduating from UCLA with a B.A. in meteorology in 1951, Art went to work for the U.S. Navy Hydrographic Office for about 5 yr. In 1956 he found his way to the U.S. Weather Bureau and the Marine Area Section in the Office of Climatology.

Art Cooperman and marine climatology eventually became synonomous. In addition to authoring an article in the first issue of the Mariners Weather Log, he planned and coordinated "Climatology and Weather Services of the St. Lawrence Seaway and Great Lakes" in 1959. He continued his work in this vein, and the result was a host of marine climatological publications to benefit the guy at sea. The Climatological and Oceanographic Atlas for Mariners series was a best seller--these soft-bound, folding atlases were ideal for carrying aboard ship.

On the international scene Art represented U.S.

Figure 31.--Arthur I. Cooperman.

interests on several fronts. His participation as a delegate to the International Maritime Consultative Organization (IMCO) in March 1966 was a major factor in updating the load-line zones. In this country his contributions have been recognized by the U.S. Department of Justice, for help in the landmark U.S. versus Louisiana boundary case, and by former Secretary of the Interior Rogers Morton for his work on the Alaska Pipeline Environmental Report.

Throughout the past decade Art has been responsible for updating the climatology on the Defense Mapping Agency's Pilot Chart series, which covers all the major oceans and seas of the world. Art has also helped plan and coordinate the Defense Mapping Agency's Planning Guide series, which has replaced the old Sailing Directions.

Throughout history men have used observations gathered by the sailor to assist him in his journeys across the sea. In 1876 Benjamin Franklin published his "Marine Observation Chart" detailing for the first time the location of the Gulf Stream. Matthew Fontaine Maury's "Wind and Current Charts and Sailing Directions" became a monument to the practical application of oceanographic knowledge. The Mariners Weather Log and Art Cooperman have continued this long-standing tradition.

Like Samuel Plimsoll, who was responsible for the first load-line legislation, Art was concerned for the safety of the mariner. And like Plimsoll, Art Cooperman can certainly be called the "sailor's friend."

Art, his lovely wife Virginia, and his son Jim plan to remain in the Washington area. Art's current residence is 416 Rosier Road in Oxon Hill, Md.

LETTERS TO THE EDITOR

YACHT INVICTUS ENCOUNTERS BRETT

The following slightly edited letter describes the sailing yacht INVICTUS' encounter with tropical storm Brett. It was sent to NOAA by Fritz L. Schweitzer, Jr. of Darien, Conn.

July 9, 1981

U.S. Dept. of Commerce
NOAA
Rockville, MD 20852

Gentlemen:

Re: Tropical storm Brett

I was aboard (as skipper) the sailing yacht INVICTUS, bound for New York from Bermuda, when we were hit by tropical storm Brett. At approximately 2300 EDT on Monday, June 29, we found ourselves in the eye of this storm. Our location at that time was approximately 35.85°N, 70.1°W (by Loran C). The storm appeared to be advancing in a somewhat southwesterly direction. Winds were northeast as we entered the eye, shifting to easterly as we re-entered the storm. Winds in the vicinity of the eye were consistently above 70 kn. In gusts, the yacht's anemometer was frequently pinned at its 90-kn maximum reading.

To the best of our knowledge, INVICTUS had already experienced Brett before it became identifiable as a tropical storm from satellite photographs, suggesting perhaps that the storm developed into its characteristic configuration with great rapidity during the early darkness hours of Monday, June 29. We had, of course, been experiencing gale-force northeast winds since Saturday evening, June 27, but the weather broadcasts we had been able to receive did not identify or suggest a tropical storm at that time.

Our best estimate, from navigational information and water temperatures, is that INVICTUS was located at the southeasterly edge of a north-going meander of the Gulf Stream when hit by the eye. The storm may have been following the Stream toward Cape Hatteras.

I would be very much interested in receiving copies of satellite photos and/or synoptic maps, or any other available information that would help us reconstruct the development of tropical storm Brett. For our purposes, a time span of June 26 through June 30 would be sufficient.

Your assistance will be greatly appreciated.

Very truly yours,

Fritz L. Schweitzer, Jr.

MARINE WEATHER REVIEW

The Smooth Log (complete with cyclone tracks, climatological data from U.S. Ocean Buoys, and gale and wave tables) is a definitive report on average monthly weather systems, the primary storms which affected marine areas, and late-reported ship casualties for 2 mo. The Rough Log is a preliminary account of the weather for 2 more recent months, prepared as soon as the necessary meteorological analyses and other data become available. For both Smooth and Rough Logs, storms are discussed during the month in which they first developed. Unless stated otherwise, all winds are sustained winds and not wind gusts.

Smooth Log, North Atlantic Weather

March and April 1981

SMOOTH LOG, MARCH 1981--There were vast differences from climatology in this month's weather pattern. The storms normally track along the St. Lawrence to Kap Farvel, where they split toward the Davis Strait and Iceland. A second track from Cape Hatteras heads northeastward toward Iceland. The major activity this month formed off the New England coast, moved eastward to midocean, then turned northeastward to northward. Several of these storms plus some from the vicinity of Iceland crossed northern Europe. There was a sparsity of storms affecting the Mediterranean.

The Icelandic Low at 993 mb was 12-mb lower than climatology and near 48°N, 36°W, over 600 mi southsoutheast of its normal location. The Azores High at 1021 mb was near 28°N, 22°W, about 12° longitude east of its normal position (fig. 32).

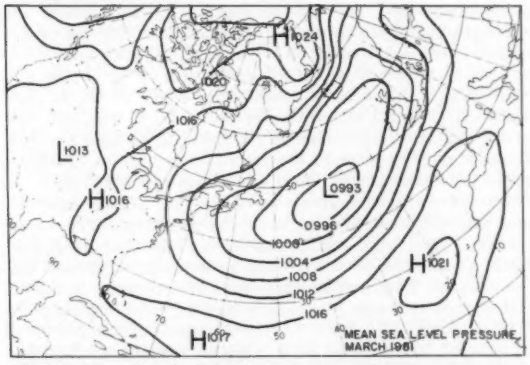


Figure 32.--North Atlantic mean sea-level pressure.

The difference in central pressure and location of the Icelandic Low resulted in a large negative anomaly covering most of the ocean, except off the east coast of Greenland and off the North African coast into southern Spain. The main anomaly centers were minus 16 mb near 45°N, 35°W, and minus 13 mb over Scotland. High pressure dominated the Arctic Ocean with a plus 10-mb anomaly.

In the upper air the primary circulation was near normally located over Devon Island, but there was another low center far south off Cape Race. This displaced the long-wave trough considerably to the east, resulting in northwesterly flow over the East Coast and the easterly path of storms off the coast. The normal slight ridging over western Europe was hardly discernible. As at the surface the majority of the ocean was influenced by below-average heights and negative anomalies.

Extratropical Cyclones--The first severe storm of the month moved out of Manitoba, Canada, on a southeasterly track. It was not an especially severe storm except for cold temperatures and snow in the northerly flow. As the LOW moved across Maine and off the coast on the 3d, a frontal wave was traveling eastward from the Carolinas. As the cold air moved over the warmer waters, the EXPORT BUYER and another U.S. ship had 40-kn northwesterly winds in the vicinity of the Gulf Stream; another reported 20-ft waves.

The storm intensified rapidly, dropping 34 mb in 24 hr to a pressure of 962 mb at 1200 on the 4th. The ATLANTIC CHAMPAGNE (41°N, 60°W) and the S.A. HUGUENOT (33°N, 62°W) both had winds of at least 60 kn. Several ships in the area had waves up to 25 ft. The PACIFIC PEACE (36°N, 55°W) measured 50-kn winds with 33-ft swells that continued into the 5th. At 0000 on the 5th, a time of minimum radio reports, there were nine reports of 45 kn or greater. The NOVO MESTO at 36°N. 47°W. was about 300 mi southeast of the 970-mb center with 72-kn westerly winds. The LASH ATLANTICO (35°N, 56°W) reported waves of 49 ft. She fought waves between 41 and 52 ft from 1200 on the 4th to 0000 on the 9th as she sailed from 36°N, 58°W, to 38°N, 50°W. The PASCAL (32°N, 51°W) had 39-ft waves, and the EXPORT BANNER (38°N, 54°W) had 41 ft. Other ships south of the center had 20- to 30-ft swell waves. On the 6th, the C.P. DISCOVERER (51°N, 39°W) had 55-kn northeasterly winds and swells as high as 43 ft. Winds south of the center were generally gale force with 20- to 30-ft waves. On the 7th the storm started to collapse as another moved eastward and an associated center rushed eastward. The MONAGAS arrived Bilbao from Havre with weather damage.

Monster of the Month--As a LOW out of the Midwest approached the Appalachian Mountains, a second LOW formed east of the mountains early on the 5th. Its center crossed the coast at Norfolk and deepened rapidly over the warmer water. There were a few gale reports near the front on the 6th. New York City and areas of New Jersey had 10 in of snow. By 0000 on the 7th the storm was 960 mb near 40°N, 59°W.

The 19,247-ton Israeli MEZADA reported a hold

flooded on the 7th while about 96 mi southeast of Bermuda. She later sank. There were 35 persons aboard but only 11 were saved. Winds of 47 kn and waves of 18 to 24 ft were reported. The HELLENIC IDEAL had engine trouble in heavy seas 200 to 300 mi away. The tug POINT CARROLL reported a barge with 5,200 tons of crushed stone broke loose on the 8th near 40°N, 62°W. The ZIM LIVORNO reported storm damage March 6 to 8 from New York to Haifa which was probably from this storm. The CONCORDIA STAR lost containers overboard on the 6th about 500 mi east of Hampton Roads and a hole was punched in a wing tank. The CASTILLO DE ALMANSA was disabled while 1,000 mi east of Philadelphia with a cargo of coal. The 44,881-ton American GOLDEN ENDEAVOR headed for Halifax, Nova Scotia, was in heavy weather on the 9th. The vessel's intended course was 275°, but she had a speed of minus 2 kn in westerly winds of force 13. Her hull was flexing and she could not turn 180° due to high following seas. The CAST DOLPHIN also suffered damage in this storm and diverted to Halifax.

The EXPORT BANNER was near the center of the storm with a 966-mb pressure, 45-kn winds. and 26-ft swell waves. At 1200 on the 7th the LASH ATLANTICO (36°N, 56°W) had 50-kn winds and 49-ft waves about 200 mi south of the center. At 1800 the seas had dropped to 36 ft, but the swells had increased to 52 ft. There were winds near 50 kn in all but the eastern quadrant. The winds were still blowing over 50 kn on the 8th with the LANTAU TRADER, 250 mi northwest of the 964-mb center, finding 52-kn northerly winds with 46-ft waves. On the 9th the LASH ATLANTICO now near 39°N, 50°W, had 41-ft waves. The winds were now decreasing in intensity, but high waves over 20 ft continued. On the 10th the DOCTOR LYKES and WERA JACOB both near 45°N, 36°W, had winds above 60 kn with 25-ft waves. The JEFF DAVIS (46°N, 42°W) had 33-ft swells. The FORT NORMAL and WERA JACOB, both southwest of the LOW, had swell waves of 49 ft and 43 ft, respectively, on the 12th. The storm moved over Ireland on the 13th and was no longer of concern.

A trough moved off the U.S. East Coast on the 12th. By 1800 a LOW had formed in the trough about 450 mi east of Cape Cod. By 1200 on the 13th a Soviet ship near 35°N, 52°W, was reporting 47-kn winds and 26-ft waves southwest of the 986-mb center near 41°N, 49°W. The IRISH PINE was 450 mi east of the center with 33-ft swell waves. On the 14th the GERTRUD JACOB (40°N, 50°W) was being pounded by 60-kn winds driving 25-ft seas and 33-ft swells. At 1300 the 41,108-ton Greek tanker HALKI radioed she was near 38°N, 39°W, in force 10 to 11 westerly winds and waves over 20 ft with damage on the deck. At 1800 the ARCTIC TROLL found 52 kn and 33-ft swells in the southeast quadrant. On the 15th the IRISH PINE was on the southwest edge of the storm with 60-kn winds, 20-ft seas, and the code indicated giant 66-ft swells on her stern. Farther along the wind trajectory and fetch the ARCTIC TROLL still had 33-ft swell waves. Later in the day another storm over Nova Scotia sapped this storm's strength, and it abruptly disappeared.

A LOW that moved north of the Great Lakes started breaking down and on the 14th a new center was found south of Cape Cod. The circulation developed rapidly over the new source of energy, and gales were blowing by the 15th. At 1200 the WERA JACOB (39°N, 57°W) had 55-kn winds with 33-ft seas and 46-ft swells. The 970-mb storm was over Nova Scotia. The CGC VIGOROUS east of Cape Cod measured 44-kn winds driving 25-ft seas with 46-ft swells. The DAWSON at 42°N, 62°W, had 65-kn winds at 1800 with 30-ft waves with only a slight decrease. On the 16th the WERA JACOB south of the 977-mb storm center again had 55-kn winds, 33-ft seas, and 46-ft swells. A ship at 35°N had 30-ft swells. By the 17th this storm was gone.

This weak low-pressure center started over northern California and raced across the southern part of the United States at about 30 kn. At 1200 on the 16th it was 994 mb over western Virginia. Twelve hours later it was 972 mb south of Cape Cod and in another 12 hr was 960 mb near Cape Sable. At 0000 on the 17th the GYPSUM KING off Cape Hatteras found 60-kn winds. At 1200 the FORT NORMAN (33°N, 59°W) had 60-kn winds and 33-ft waves. The AMERICAN TRADER had 50 kn. There were many ships with winds stronger than gale force. The WERA JACOB, an ore carrier which appeared to be loitering in the area, again had 60-kn winds, 23-ft seas, and 39-ft swells. The AMERICAN LEGEND was near 43°N, 61°W, at 1800 with 55-kn southeasterly winds, 20-ft waves, and a sea-level pressure of 965 mb. Less than an hour later the pressure dropped to a minimum of 962 mb. By 0000 on the 18th the winds were 63 kn from the west with 23-ft waves. The storm was now traveling northward over the Maritime Provinces. The high winds and waves reached as far south as latitude 30°N but were retreating northward by the 19th. This was the result of the transfer of the circulation to a new low center that formed southeast of Cape Race. The ESSO KARACHI with 138,000 barrels of oil aboard broke loose from a tug in heavy seas 50 mi south of Bermuda on the 18th. She had been taken in tow after developing engine trouble. The tug later reconnected. By 1200 on the 19th this new center had taken over. There were several storm wind reports and waves up to 20 ft.

On the 20th yet another center formed farther east which supported some gales, but the swell waves had built as high as 30 ft in the westerly flow. This center moved over the North Sea on the 22d.

The bulkcarrier ARIADNE out of Dunkirk had a cargo of steel pipes shift in heavy weather on the 22d and diverted to the Azores to resecure probably due to this storm. The French container vessel ST. BERNAD, while docking at Le Havre, hit the Russian tanker GURZUF in 60-kn winds. The French tanker

LIVORNE PACIFIQUE at Antifer Port had to stop discharging due to the high winds.

A LOW that came across Cape Hatteras and moved northeastward left a weak trough off the coast and a frontal wave formed and filled the void on the 20th. Using the other circulations as a base, this LOW developed into a large storm. It originally moved northeastward then on the 21st turned southeastward. At 0600 the CJR6 had 58-kn northeasterly winds near 44°N, 59°W, with 38-ft waves. At 1200 on the 22d the 980-mb storm was near 41°N, 50°W. An American ship that may have been the DEFIANCE (38°N, 58°W) had 40-ft waves. At 1800 the EL PASO ARZEW (35°N, 51°W) had 52-kn winds and 36-ft waves.

The storm continued eastward with winds up to 50 kn and waves up to 30 ft until turning northward on the 24th. Romeo was tossed by 30-ft seas on the 25th. The AMERICAN LEGACY 200 mi southwest of the 964-mb center had 50-kn winds, as did several other ships, with 33-ft waves. She was under the area of maximum vorticity advection. Icelandic fishing vessels north of the center were reporting 60-kn winds. Ships moving through this same area in the southwest quadrant on the 26th also found winds near 50 kn and waves up to 33 ft.

Another LOW was moving eastward south of this one and sapping its strength. On the 29th the storm was gone.

Casualties--These ships had problems in fog: the SNOW HILL and EUGENIE C. collided south of Port Arthur. The AVELINA ran aground south of Larache, as did the MIQUELON off southeast Sweden. The CARMELITANA MADRE and KONSTANTINOS K. collided 10 mi northeast of Ancona, Italy. The following vessels requested weather damage surveys during March: AVLIS, BOOKER CRUSADE, EASTERN COUNTESS, EL CHAMPION, LA LIMA, and PLATONIC. High winds resulted in the dragging of anchors or other damage to these ships: CUNARD COUNTESS, ENERGY CREATION, GLORY, NOPAL MASCOT, and OGDEN NELSON.

The 4,675-ton IRANDA ran aground on the 3d near Crete in heavy weather. The ELOCEAN was stranded near Piraeus in bad weather, and the ADRIA ran aground in the Gulf of Ageba on the 19th. The CITY OF TEMA developed a 30° list when bad weather caused her cargo to shift in Flushing Roads on the 23d. She also ran aground.

The 1,476-ton CURRENT VENTURE arrived Miami from New York on the 27th with weather damage. Two 499-ton West German ships had problems. The last week of the month the WHESTSTAR was missing on a voyage to the Azores. Also, the WHESTTRADE arrived Casablanca with weather damage. The ALEXA arrived La Coruna with weather damage from the 28th. The British MYRMIDON reported weather damage on the 29th on arrival at Havre. The MULTAN returned to Bilbao with weather damage on the 29th. The RIO CALCHAQUI put into Vigo on the 31st with weather damage, and the SUNNY KARINA was at La Goulette Roads after encountering heavy weather.

Other Casualties--The 6,000-ton Pakistani LALAZAR sustained weather damage off the Cape of Good Hope on the 4th to the 6th. The 8,295-ton Dutch AMERSFOORT encountered heavy weather on a voyage from Houston to Durban.

SMOOTH LOG, APRIL 1981--The ocean south of latitude 40°N hosted only two significant low-pressure systems. No storm managed to survive a complete crossing. Several storms formed on the east side of a blocking HIGH off Europe and entered the continent. There were three short-lived storms over the Mediterranean. The primary storm track matched one of the climatological tracks from the Great Lakes to over the Canadian Maritime Provinces, where the track split into the Labrador Sea and to the Denmark Strait. This was the only track of any importance. A climatological track from off the U.S. East Coast did not exist.

The mean sea-level pressure pattern was skewed counterclockwise. The 1008-mb Icelandic LOW was the Labrador Low at 50°N, 60°W. The Azores High at 1024 mb was shaped like a boomerang with a second 1024-mb center west of Ireland. Even though the Icelandic Low was 1,000 mi southwest of its climatic position, the pressure over the southeastern United States was 4 mb above normal (fig. 33).

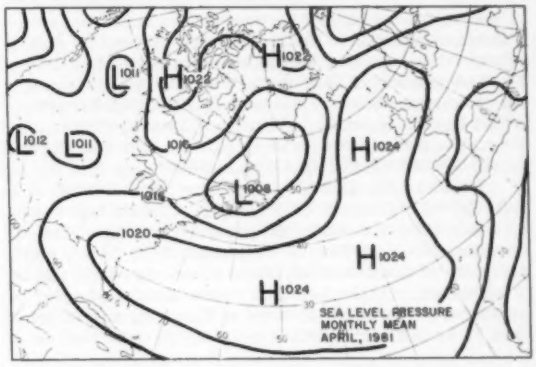


Figure 33.--North Atlantic mean sea-level pressure.

The displacement of the pressure centers from the normal resulted in a large 13-mb positive anomaly center over the Rockall Bank and a minus 4-mb center near Corner Brook, Newfoundland. There was also a positive 4-mb area between latitudes 30° and 40°N and the Carolina coasts and longitude 45°W.

The upper air pattern over the eastern United States was near normal out of the west-northwest, but the trough along 60°W was sharper than usual. Also, there was a sharp ridge west of the European coast, which resulted in air flow slightly south of southwest toward Iceland from the central Atlantic. These surface and upper air ridges diverted the cyclones to the north away from Europe.

Extratropical Cyclones--The first storm this month moved across the Maritime Provinces on March 31. It was not until April 1 that it became significant. At 1200 it was off Cape Race. The KRTB and SEDCO east of Cape Race both had 50-kn winds. The OCEA nearby had 25-ft seas 6 hr later. The WILDENTE reported 60-kn winds with 26-ft waves at 2100. On the 2d the ATLANTIC CAUSEWAY and C.P. DISCOVERER in the vicinity of 50°N, 43°W, both had 33-ft swell waves. Their winds were 40 to 55 kn.

At 1200 on the 2d, the pressure was 980 mb near 53°N, 30°W. There were many wind reports over 40

kn and some as high as 55 kn with waves of 25 to 33 ft. On the 3d the storm was pushing against a HIGH over Scotland and weakening. There were still a few gales. Another center had formed on the front west of Portugal. The original storm was gone by the 4th.

A LOW that developed over the eastern slopes of the Rocky Mountains tracked across the Great Lakes but dissipated on the 6th as another center formed over the Gulf of St. Lawrence. At 1200 on the 7th the storm was 983 mb near Cartwright, Labrador. A ship with the call letters WFLH (38°N, 67°W) on the southwestern edge of the storm reported 53-kn winds. At 1800 there were reports of 40- and 45-kn winds over the Gulf of St. Lawrence. There were a few gale reports on the 8th behind the front. On the 9th at 1200 the storm was over Iceland and on the 10th was racing toward Spitsbergen. The KUNUNGUAK at 59°N, 38°W, had 44-kn winds with 26-ft seas. Later in the day another LOW formed in the elongated trough northeast of Kap Farvel.

A weak LOW was traveling eastward across southern Canada on the 11th. By the 12th this center had disappeared and another had appeared over the Gulf of St. Lawrence. At 1200 on the 12th the 996-mb storm was near Cape Race. The SEA-LAND LEADER (40°N, 54°W) had 40-kn winds, while the EDWARD CORNWALLIS (45°N, 61°W) found 45 kn. At 1800 the SEA-LAND VOYAGER (44°N, 43°W) had 50 kn.

At 1200 on the 13th the storm was 990 mb south of Kap Farvel. Ocean Weather Station Charlie had 40-kn winds from the south just prior to passage of the occluded front. A Belgian ship near 50°N, 35°W, was also east of the front with 50-kn southerly winds and 30-ft waves. On the 14th this storm also came up against a stubborn HIGH north of Scotland, and in less than 24 hr it disappeared.

On the 14th an old weak front stretched southwestward between cells of the Bermuda and Azores Highs. Cyclonic circulation was found on the front on the 15th. As often happens with meteorological systems, they don't behave as they should. This frontal wave moved south along the front instead of north. On the 16th the LOW turned northerly again as the Azores High retreated northward. The first strong wind was recorded on the 17th by the LACKENBY with 47 kn and 20-ft swells near 47°N, 41°W. At this time another wave had formed on the front as the first one dissipated. On the 18th there were a few gale reports with seas as high as 20 ft. The DRUCILLA U (36°N, 40°W) reported 33-ft swells. On the 19th the FALSTRIA near 43°N, 28°W, had 40-kn winds and 26-ft swells. Another storm was moving into the area from the west and absorbed this one.

This storm originated over Alberta, Canada, and traveled eastward along the border. The first gales were found on the 18th off the East Coast. On the 19th a Canadian ship near 49°N, 59°W, reported 61-kn winds. There were some wave reports of 20 ft. At 1200 on the 20th the 994-mb storm was near 42°N, 50°W. The CARCHESTER (49°N, 34°W) found 44-kn easterly winds. A ship to the south had 23-ft waves. On the 21st the storm was weakening.

This storm formed near Cape Cod. As it moved over the Gulf Stream, it deepened and produced gales off the East Coast on the 21st. A Canadian reporter that was stationary near 44°N, 59.5°W, had winds over 45 kn and waves up to 20 ft on the 22d. Also, the SEA-LAND GALLOWAY (42°N, 62°W) found 20-ft waves. At 0000 on the 23d the LOW was 984 mb over Cabot Strait. That Canadian reporter near 44°N, 59.5°W (CJR6), probably a drilling rig, now had winds greater than 50 kn. The GENERAL JASINSKI, sailing toward the northeast near 39°N, 64°W, was finding winds higher than 50 kn. The storm was over Newfoundland on the 24th and loosing its punch as another circulation to the southwest eroded that quadrant where the stronger winds tend to be found. The storm stalled near 50°N, 55°W, and was gone on the 25th.

Casualties--The STANISLAW DUBOIS and OMDURMAN collided in fog on the 2d off Rotterdam. The MONZA touched rocks in fog while entering Pasajes, Spain, on the 3d. On the 8th the PRINSES PAOLA contacted a mole entering Dover.

On the 11th the MED AMBITION anchored off Las Palmas for a survey and temporary repair of heavy-weather damage. The GREEK SKY returned to Malta because of heavy-weather damage to her air cooler. The 3,619-ton AFRODITI P. was stranded outside Leixoes Harbor on the 13th with engine failure in heavy weather. According to a bulletin dated the 14th the AMIRA K. dragged anchor at Alexandria and contacted the PYRAMIDS U.

The POINT SUSAN was disabled with no power near 37°N, 36°W, on the 18th in heavy weather. The KILKENNY lost the starboard anchor and 26 ft of cable during heavy weather while approaching Rotterdam on the 19th.

The tourist vessel BERDICE (90 tons) capsized on the 22d, 400 mi south of Cairo, in a thunderstorm. Thirteen of the 83 passengers were missing. The Greek EVA suffered engine damage in heavy weather on the 23d enroute to Pasajes. The 1,195-ton MATHILDA suffered damage when adverse weather carried the ship onto the quay wall while berthing at Dublin on the 25th. The SAINT NAZAIRE from Dakar to Basse Indre reported heavy-weather damage on the 26th. The 471-ton WEGRO was swept aground on the 26th at Great Yarmouth by gales.

The CHOCANO grounded in heavy weather on the 27th at Leghorn. The BALDER CABOT lost a container overboard on the 30th near 61°N, 01°E, in 55- to 65-kn winds.

Other Casualties--Another "freak" wave off South Africa. The Liberian ENERGY ENDURANCE with 200,000 tons of oil aboard was hit by a large wave south of Durban. Bow plates were sprung and peeled back at the 60- to 65-ft level. An oil slick 100 mi long, 30 mi off the coast resulted from the spilling of 3,000 tons of bunker oil.

Smooth Log, North Pacific Weather

March and April 1981

SMOOTH LOG, MARCH 1981--The number of storms appeared to be near normal, but the average storm was deeper than normal as indicated by the mean pressure. One primary storm path stretched northeastward from near Tokyo to near Umnak Island. Another was northward to the Alaska Peninsula from the vicinity of 45°N, 165°W. There was a secondary track from the Kurile Islands into the central Bering Sea and another from off Vancouver Island northward toward Yakatat. These approximated climatology, especially the first primary track.

Climatology shows two centers for the Aleutian Low: the primary one near 50°N, 170°E, and the other over the Gulf of Alaska. This month's mean center was 989 mb near 53°N, 171°W, about half way between the two climatic centers. The Pacific High had two 1023-mb centers along 30°N at 160°W and 138°W and stretched farther west than normal (fig. 34).

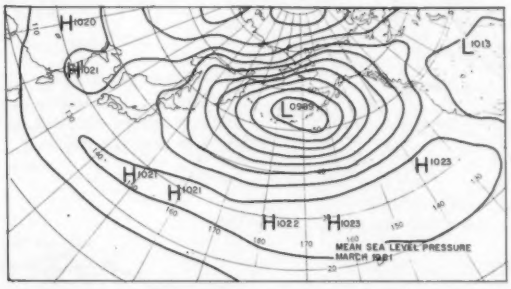


Figure 34.--North Pacific mean sea-level pressure.

There was one large minus 19-mb anomaly center near 53°N, 166°W. The zero isoline approximately paralleled latitude 35°N from California to 170°E, where it turned northwestward into the Sea of Okhotsk.

The 700-mb low center was over the central Bering Sea rather than the Sea of Okhotsk. The pressure surface heights were basically below normal north of latitude 35°N and higher south of that latitude. The normal ridge over the Rocky Mountains was more pronounced than normal with positive anomalies along that coast.

Typhoon Freda developed among the Marshall Islands.

Extratropical Cyclones--This storm was first traceable south of Honshu on the 3d. The NEW GOLDEN PHOENIX (31°N, 153°E) was east of the front sailing westward with 58-kn southwesterly winds on the 5th. A ship near 39°N, 152°E, which the LOW had passed over at about 2000 on the 4th, had 30-ft swell waves. By 1200 on the 5th the storm was 976 mb near 44°N, 165°E. The NOPAL BRANCO (41°N, 163°E) measured winds of 63 kn with 41-ft waves. The PACIFIC VENTURE (39°N, 152°E) measured only 44 kn, but the waves were 30 ft. On the 6th the LIONS GATE BRIDGE was in the southwest quadrant of the storm with 68-kn winds, 20-ft seas, and 31-ft swells. Other ships registered strong gales and waves of 20 to 26 ft. By 0000 on the 7th the LOW was 960 mb. The Chinese BLHW was 750 mi to the south with 23-ft seas and 33-ft swells. The SOHIO INTREPID (52°N, 149°W) had 54-kn winds on the 8th. Other ships were reporting 20- to 25-ft waves. The HOEGH MIRANDA (45°N, 159°W) reported 39-ft swells. The MOBIL MERIDIAN (55°N, 137°W) measured 63-kn winds. Her waves were 33 ft on the 9th. Winds up to 55 kn were measured by the TRIUMPH. Winds up to 50 kn and waves to 20 ft were measured on the 10th, but they were associated more with frontal waves moving around the periphery of the storm than with the storm itself. The low center dissipated on the 10th.

This storm came out of the Amur River Valley of eastern Asia. On the 8th it was 998 mb east of Hokkaido. Several ships off the coast of Japan had gale-force winds. The storm was racing eastward at about 40 kn. There were isolated reports of winds up to 45 kn and waves to 20 ft south and west of the center on the 9th. The storm turned northeastward on the 10th and was one of those that circled the previous storm. On the 11th the 977-mb storm was in the Gulf of Alaska. The pressure gradient between the front and the coast was tightening. The PHILADELPHIA and ARCO FAIRBANKS were near each other in the vicinity of 57°N, 143°W, with 50- and 55-kn winds and the former had 29-ft waves. Ships to the south and southwest reported gales and over 20-ft waves. Buoy 46004 measured 21-ft waves. This LOW disappeared on the 12th as another deep storm approached.

A frontal wave moved over the Yellow Sea from the mainland and quickly developed over the warmer water. It traveled east-northeastward under upper air zonal flow and was 990 mb near 40°N, 155°E, at 0000 on the 10th. There were several 50-kn wind and 20-ft wave reports. Two ships reported 49-ft swell waves on the 11th and 12th, the EASTERN WORLD (48°N, 179°W) and the HOEGH MIRANDA (43°N, 174°W). On the 12th the storm was 964 mb near 50°N, 175°W. It was a large storm, but the winds and waves were still relatively light. On the 13th the pressure had reached 956 mb, and the center was essentially stationary near 53°N, 163°W. Its circulation reached from Kamchatka to British Columbia. Most winds were gales with waves near 20 ft. The highest wind on the radio broadcast was 48 kn in the Gulf of Alaska, but the CRYSTAL STAR mailed in an observation of 60 kn, and two ships reported 33-ft waves. Another LOW was racing into the southwestern quadrant. Late on the 14th a SHIP (42°N, 175°W) found 60-kn winds and 26-ft swells. This LOW disappeared on the 15th over Bristol Bay, but other centers kept the cyclonic circulation alive. By this time the major problem was waves over 20 ft in the northwesterly flow. This last storm had broken down by the 17th.

Another oriental storm. This one traveled over Korea and blossomed to 992 mb over the Sea of Japan. The CHAMPAGNE was east of Hokkaido at 1800 on the 14th

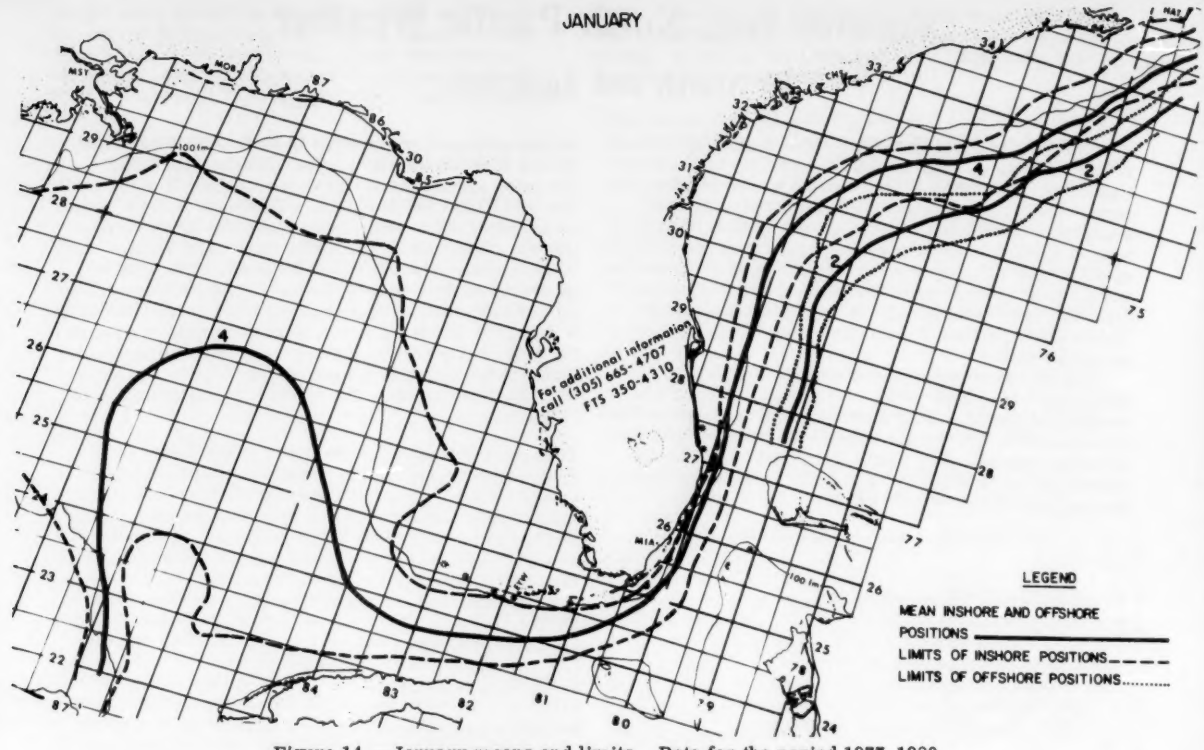


Figure 14.--January means and limits. Data for the period 1977-1980.

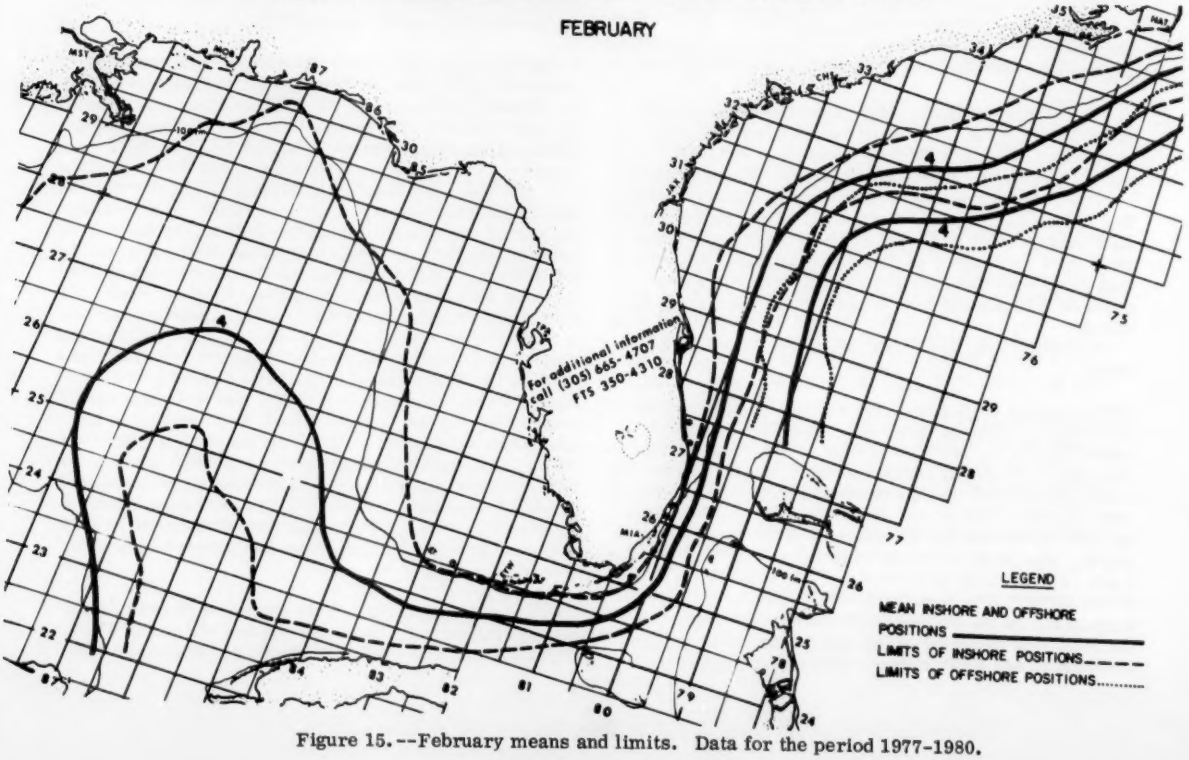


Figure 15.--February means and limits. Data for the period 1977-1980.

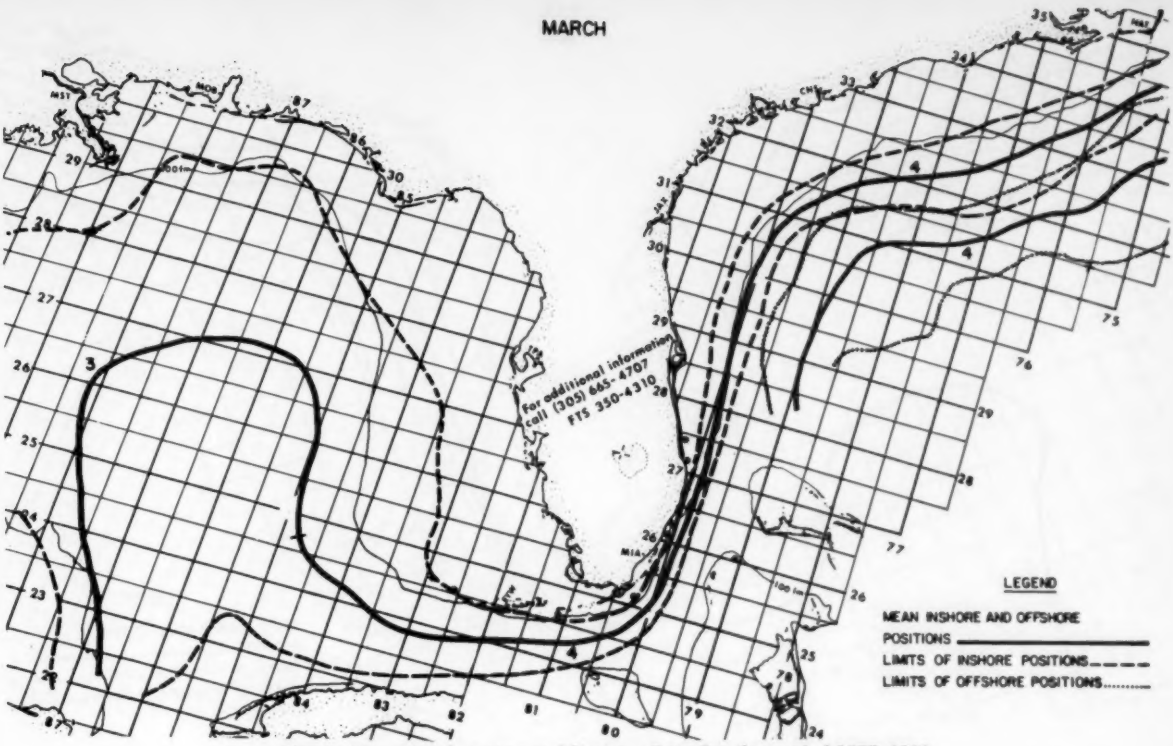


Figure 16.--March means and limits. Data for the period 1977-1980.

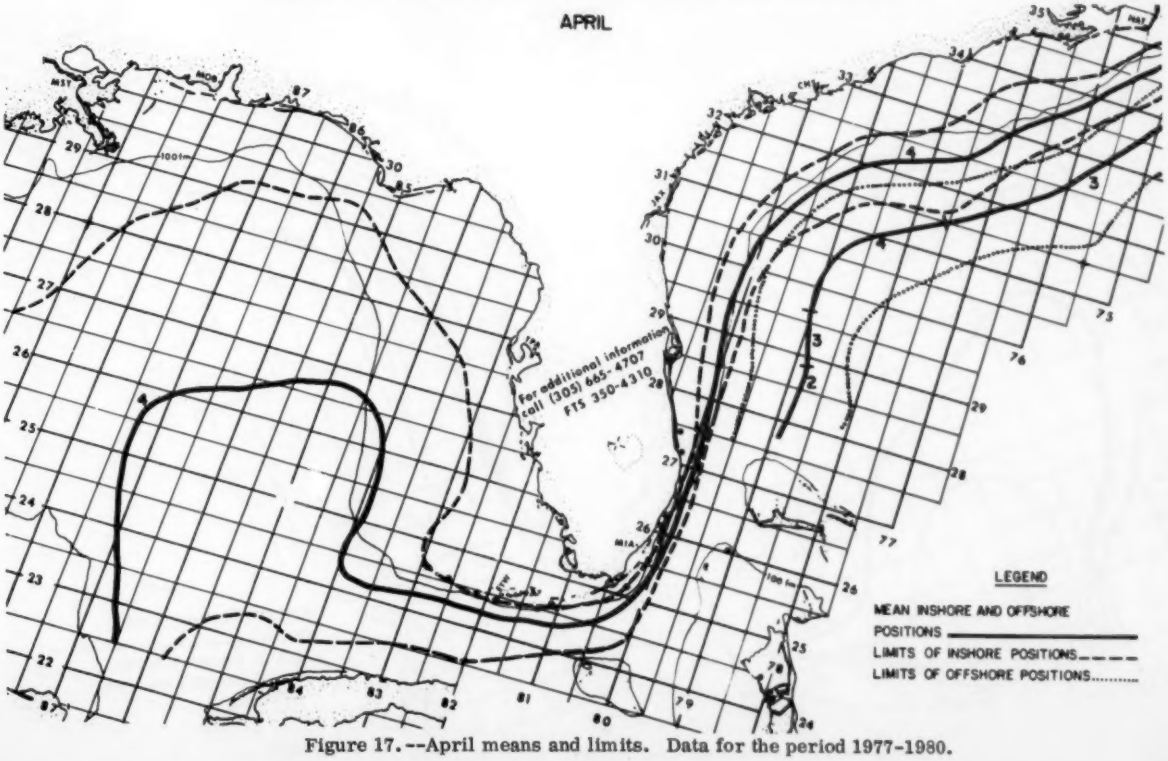


Figure 17.--April means and limits. Data for the period 1977-1980.

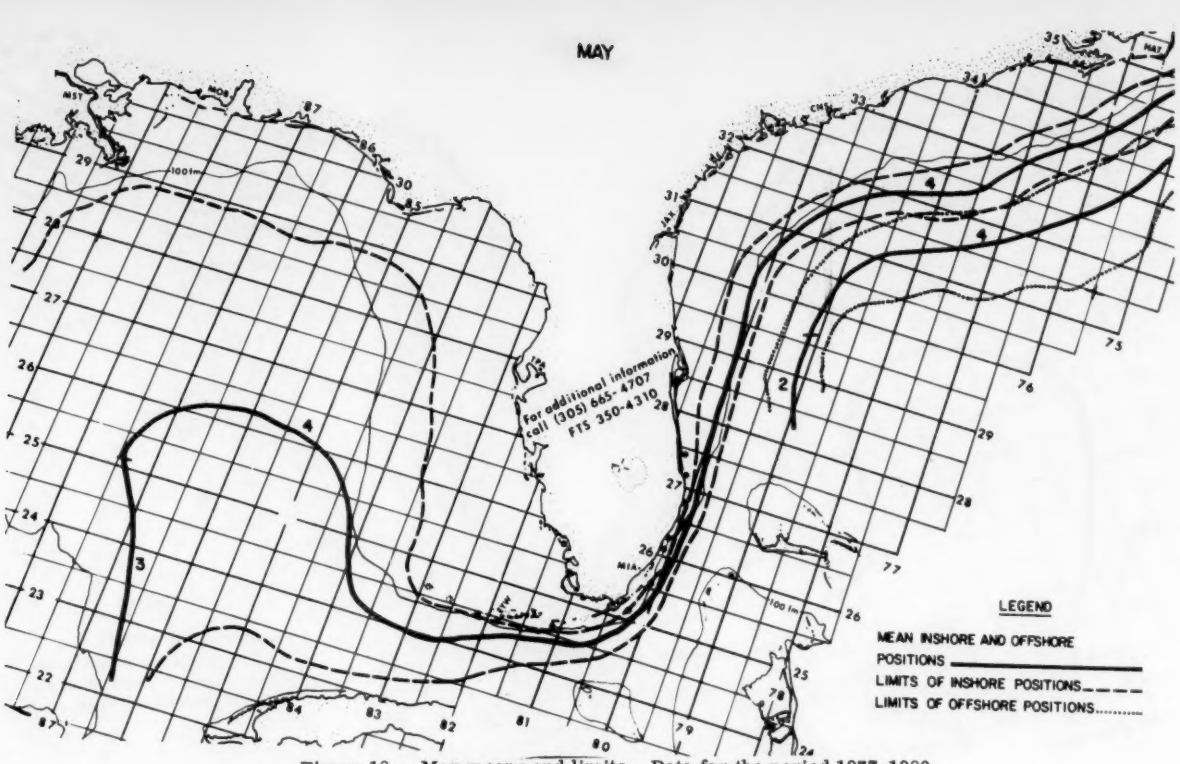


Figure 18.--May means and limits. Data for the period 1977-1980.

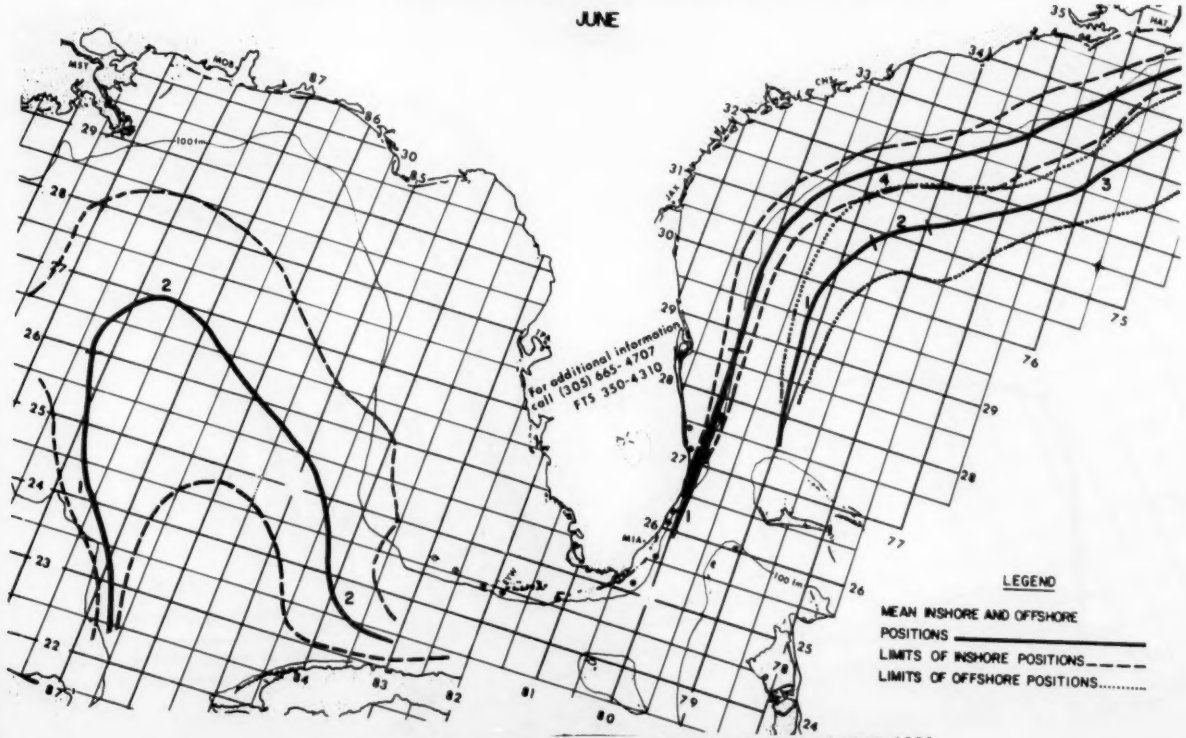


Figure 19.--June means and limits. Data for the period 1977-1980.

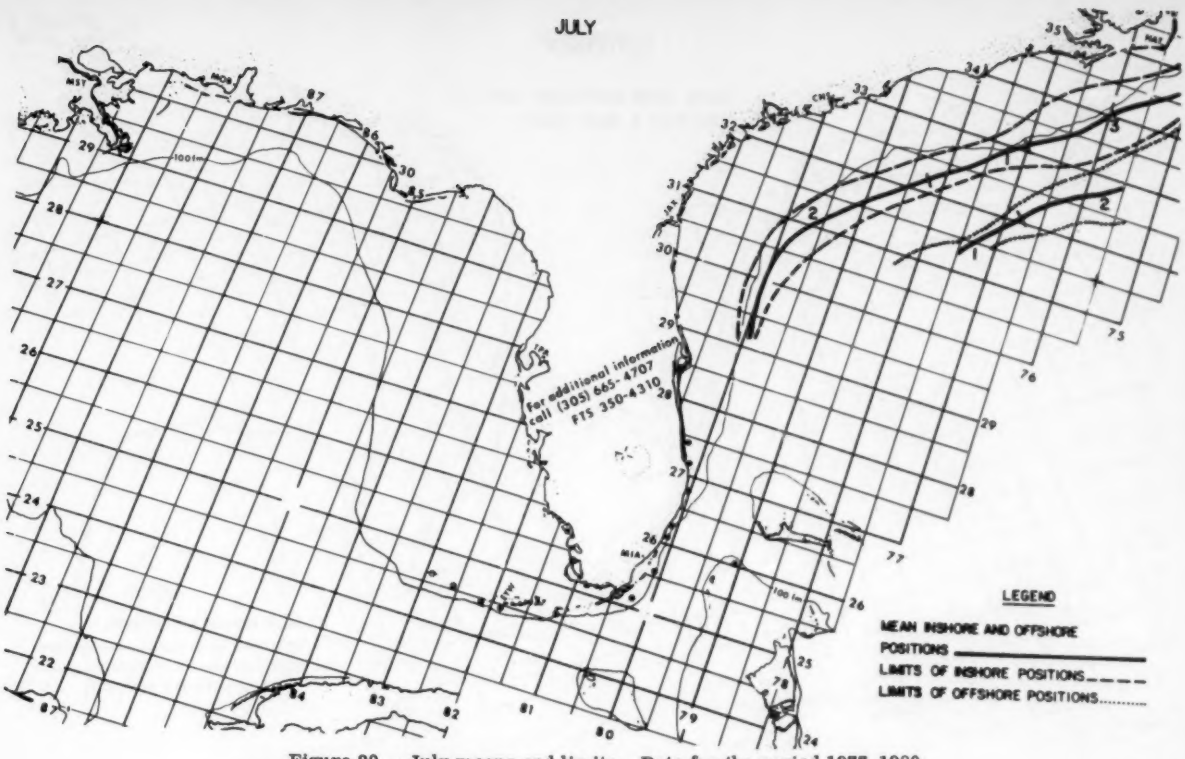


Figure 20.--July means and limits. Data for the period 1977-1980.

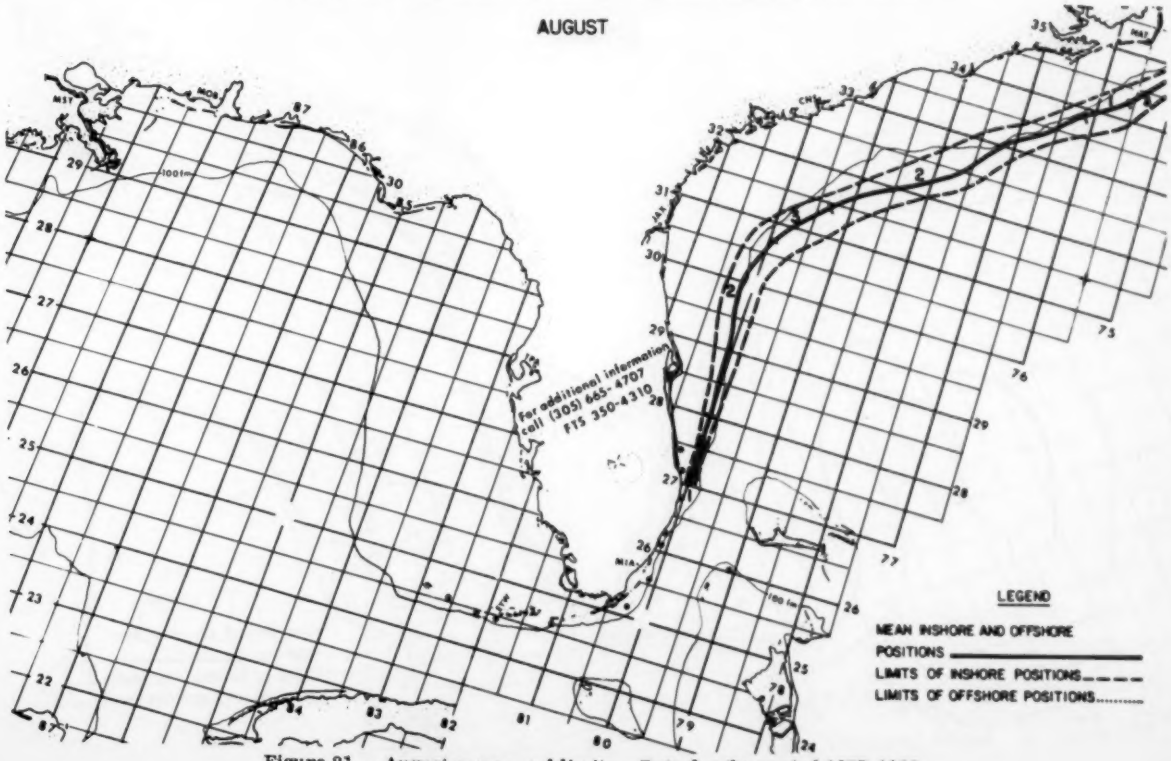


Figure 21.--August means and limits. Data for the period 1977-1980.

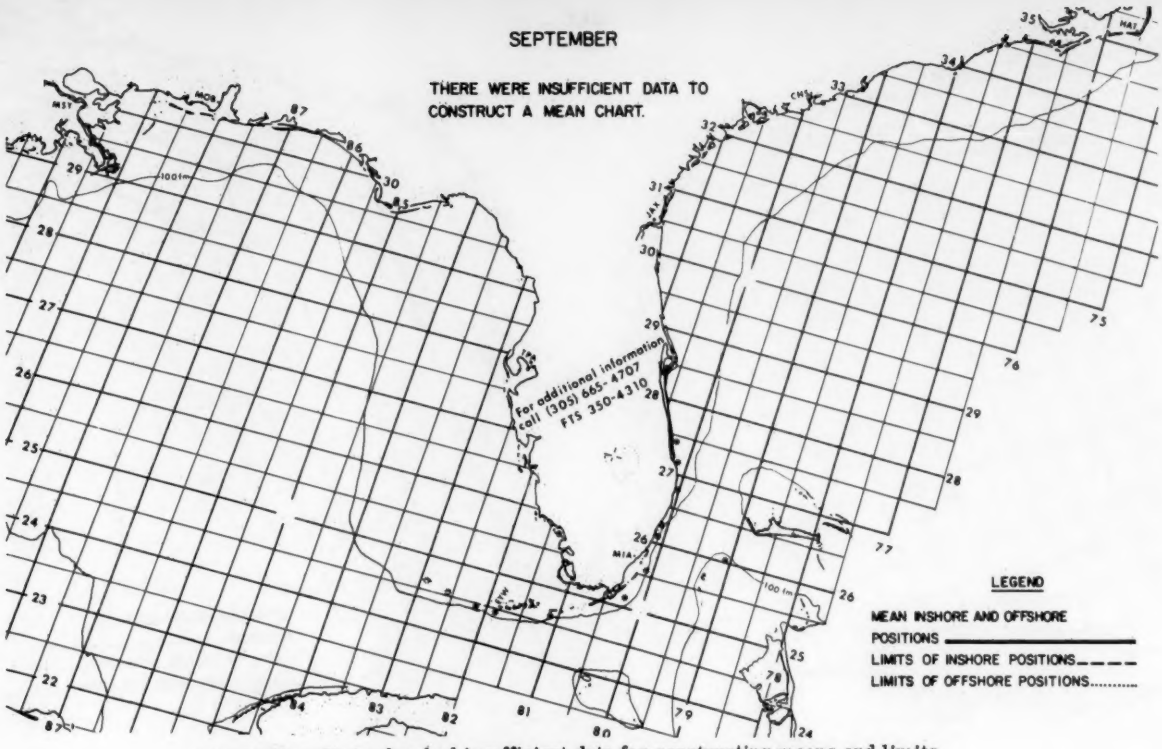


Figure 22.--September had insufficient data for constructing means and limits.

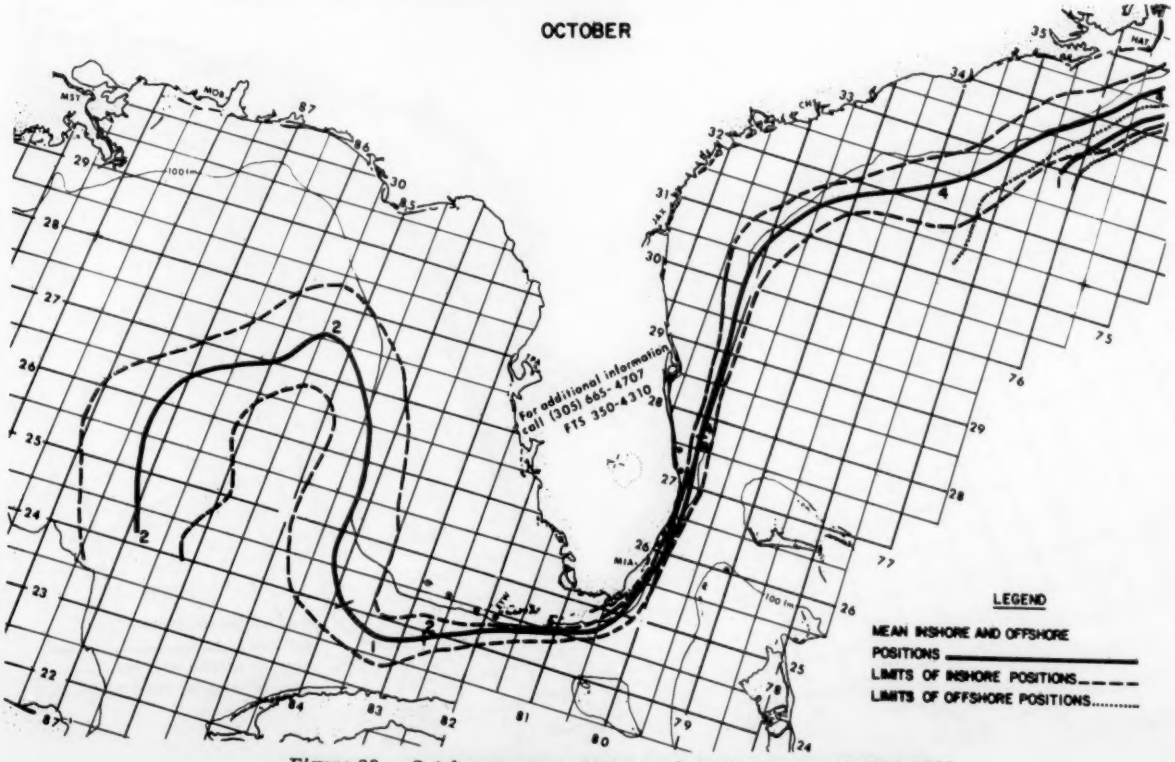


Figure 23.--October means and limits. Data for the period 1977-1980.

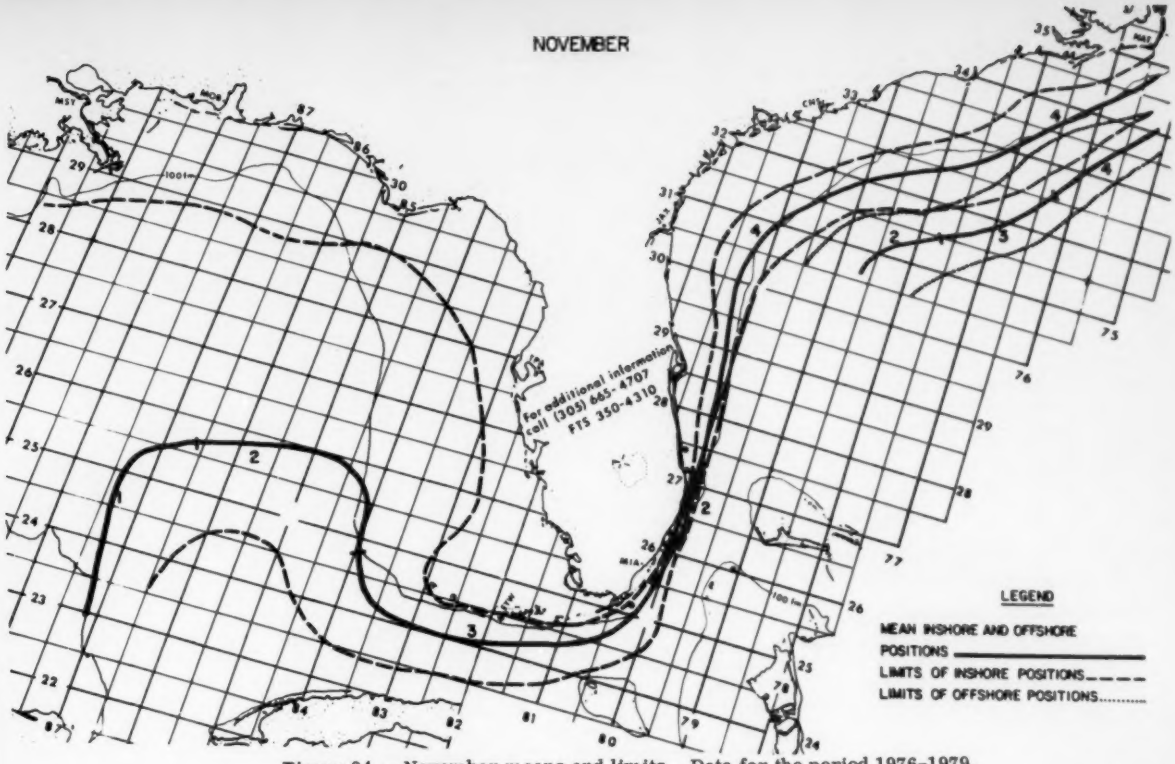


Figure 24.--November means and limits. Data for the period 1976-1979.

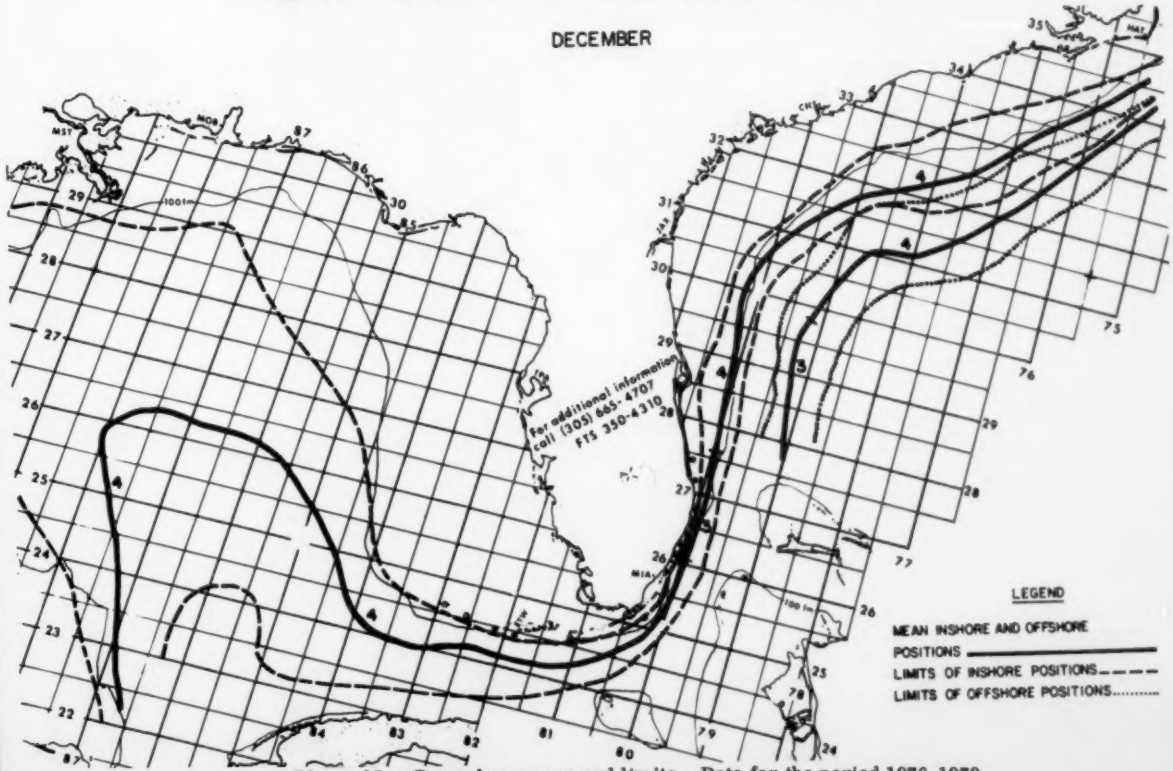


Figure 25.--December means and limits. Data for the period 1976-1979.

with 45-kn southeasterly winds and 25-ft seas. A frontal wave that formed over Honshu reinforced the storm on the 15th. The SEA-LAND MCLEAN was at 36.6°N, 147.7°E, sailing eastward at 0800 on the 15th. The center of the frontal wave must have passed directly over the MCLEAN as indicated by the pressure jump on the barogram. The pressure rose 8.5 mb in about a half hour. At 0600 she logged southerly 40-kn winds with 18-ft seas. At 1200 the winds were 30 kn from the west with 13-ft seas. The analyses made at the time indicated the LOW passed farther north and not as deep as the barograph on the MCLEAN indicated. Information from the HIKAWA MARU indicated that a Russian container ship had container loss and suffered other damage in this same area. Also the ONOMICHI MARU with a cargo of ore sank. At 0000 on the 16th the storm was already 956 mb over the Kurile Islands. The PRESIDENT FILLMORE (46°N, 155°E) found 65-kn winds and 36-ft waves. Soviet and Japanese fishing vessels among the Islands found 45- to 55-kn winds with waves up to 25 ft. On the 17th the SPRAY CAP (38°N, 178°E) was in the warm sector just east of the cold front with 70-kn southerly winds and waves of 31 ft. The SANKOSUN (47°N, 163°E) had winds of 50 kn and 34-ft swell waves. At 0600 the BLUE BELL (49°N, 166°E) registered 967 mb about 180 mi south of the center with 36-ft seas and 49-ft swells. The PAC MERCHANT (43°N, 156°E) was sailing into 55-kn westerly winds with 30-ft waves.

By the 18th the storm was over the western Bering Sea and weakening. Ships north of latitude 45°N still found 20-ft waves. The storm stalled northeast of Ostrov Beringa on the 19th and dissipated 48 hr later. On the 18th there was a 1061-mb HIGH centered near the North Pole which blocked this storm. Circulation around this enormous HIGH extended over North America as far south as Mexico.

This frontal wave was first analyzed over the Ryukyu Islands on the 18th using island, buoy, and ship reports. A large high-pressure center to the east was racing (for a HIGH) eastward along latitude 32°N. A Japanese ship near Tokyo Bay reported 50-kn easterly winds as the storm passed slightly to the south on the 20th. By 0000 on the 22d the storm was 980 mb near 42°N, 177°W. Several ships found winds of 50 kn. Among them were the OCEAN BRAVE and NEPTUNE DIAMOND, which had 26-ft waves at 0600. By 1800 the SEA-LAND EXPLORER (40°N, 167°W) measured 62-kn winds, 33-ft seas, and 52-ft swells. At 0500 on the 23d the winds were 50 kn, seas 33 ft, and swells 46 ft.

Late on the 23d the LOW split into two centers--the southern one almost over a ship that had 26-ft waves. On the 24th four ships on the southwest quadrant had swell waves over 25 ft. The PRESIDENT VAN BUREN was 1,200 mi southwest of the center with a 13-kn breeze, but 42-ft swell waves out of the northwest. By 1200 only one LOW center existed as it moved into the Gulf of Alaska. The CGC SPAR (45°N, 152°W) had 25-ft waves. The storm weakened rapidly on the 25th as a larger, deeper storm moved toward the Alaska Peninsula.

This storm was born in the East China Sea on the 20th. It took the usual east-northeast trail but was of little consequence until the 24th. The PRESIDENT TYLER, on the western edge of the storm, found 50-kn winds and 31-ft seas. The CORAL ACE (38°N, 169°E) reported 58-kn winds. On the 25th the storm was 960 mb near 47°N, 180°. The SEA-LAND INNOVATOR (42°N, 174°E) measured 55-kn winds, 30-ft seas, and 33-ft swells that were pounding her stern. Waves up to 26 ft were reported as far as 1,000 mi southwest of the center. A Panamanian ship, which apparently had some of the numbers in her pressure reversed, was very near the storm's center with 50-kn winds and 26-ft waves. This also appeared to be the case 6 hr later since everything fit when two numbers in the pressure were changed. The storm began its weakening process on the 27th.

Tropical Cyclones, Western Pacific--Typhoon Freda, the first tropical cyclone of the season, developed among the Marshall Islands on the 12th. Reaching tropical-storm strength the same day, she headed west-northwestward. A strong upper level southeasterly flow temporarily restrained her vertical development and hence her intensification. By the 14th Freda started to recurve after passing just west of Eniwetok Atoll. The following day she intensified rapidly as winds climbed to 85 kn and finally 105 kn with gusts to 130 kn; gales extended out 200 mi in the northern semicircle and 100 mi elsewhere. Freda was now heading northeastward for Wake Island. However, beyond Wake was cooler water and a strong band of mid to upper level westerlies that was to spell her doom. She weakened slightly as she passed within 60 mi west of Wake early on the 16th; winds near her 945-mb center were estimated at 100 kn. As Freda crossed the 20th parallel, she continued to weaken and turn extratropical. By the 17th she was down to tropical-storm strength and turning eastward.

Casualties--The 10,625-ton GLADIOLUS encountered heavy weather near Unimak Pass. Stanchions were damaged, chains broken, and bulwark cracked. The vessel proceeded to Kodiak for repairs and restowing. The fishing vessel PACIFIC ANGEL grounded on the 6th in bad weather about 100 mi southwest of Kodiak. The DAITO MARU No. 55 sank about 380 mi northwest of Adak on the 13th in rough seas with hull icing. All 26 crewmen were lost even though one ship was within 2 mi and some 30 ships converged on the area to help search.

A hydrofoil went aground on the 19th between Hong Kong and Macao in a heavy thunderstorm. Eighty-five of the 170 passengers were taken to hospitals, but only 25 required treatment. On the 23d the NIHON ALPHA was anchored off Midway Island with storm damage.

The following vessels were either in or due Japan with weather damage: AMSTELMOLEN, CLASSIC, MARCONA TRADER, and the DAISY.

Other Casualties--The fishing vessel LIEN HO No. 1 struck a reef near 11°S, 166°W, in bad weather on the 2d. The crew got safely ashore. Three barges were surveyed at Kandla, India, for damage in heavy weather and subsequent stranding while in tow of the tug KESARIT.

SMOOTH LOG, APRIL 1981--There was no favorite cyclone path this month. The area east of Japan

was the favorite area for storms to develop. There were three weak mean storm paths. From north to south they were from Sakhalin Island toward the Bering Strait; east of Hokkaido to Adak to the Alaska Peninsula; and 35°N, 180° to the Queen Charlotte Islands. The last two paths were a fair match for the climatic paths.

The normal mean sea-level pressure chart shows the Aleutian Low as a multicentered sausage-shape centered on about latitude 55°N. This month there were two distinct centers, one 1002 mb near 53°N, 165°E, and the other 1009 mb south of Yakutat. The Pacific High was near normal in configuration, but about 3 mb higher in pressure (fig. 35).

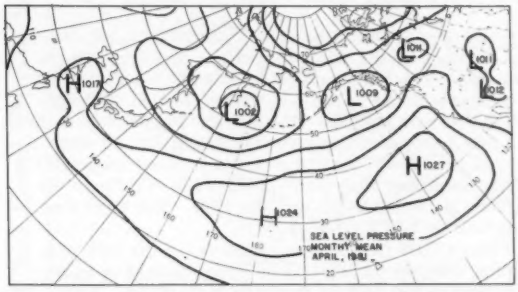


Figure 35.--North Pacific mean sea-level pressure.

The departures from normal were not spectacular. There was a negative 8-mb center over east-central Kamchatka, and a negative 3-mb center near Dixon Entrance. There was a positive 4-mb center near 38°N, 135°W, which stretched to the Oregon coast.

The normal upper air flow is zonal between latitudes 30° and 50°N and was that way this month. The gradient was slightly stronger than usual. The major departures from normal were two accentuated troughs associated with the two Aleutian Lows.

Tropical storm Gerald and typhoon Holly occurred over the western ocean.

Extratropical Cyclones--This first storm came out of southern Japan. Gales and waves to 20 ft were already blowing over the Sea of Okhotsk and east of Hokkaido on the 2d. The PRESIDENT MCKINLEY (35°N, 141°E) found 33-ft swell waves, and the PERENNIAL ACE (41°N, 152°E) measured 55-kn winds at 1500. By 0000 on the 3d the storm had plunged to 964 mb near 45°N, 150°E. Several ships found winds as high as 60 kn. Two of them were the APJ KARAN at 42°N, 144°E, and the BLUE OCEAN near 44°N, 148°E. The PRESIDENT MCKINLEY (36°N, 146°E) had only 40-kn winds but her swell waves were 38 ft. The storm was tracking northeastward on the 4th, generally with gales, but the OCEAN LOG (41°N, 178°E) had 70- and 66-kn winds at 0000 and 0600, respectively. The SEA-LAND LIBERATOR had 20-ft waves, and the TAKAI MARU (43°N, 163°E) had 26-ft waves.

The storm was over the Bering Sea on the 5th, and the pressure was rising. There were still a few gales and swell waves over 20 ft. The storm moved over Alaska on the 7th near Nunivak Island.

A frontal wave over the northern Sea of Japan on the 6th was the beginning of this storm. It developed very quickly over the Kuroshio and Oyashio Currents. At 0000 on the 8th the SEA-LAND INNOVATOR had gales and 25-ft waves from the southeast off Mys. Lopatka. The island station of Ostrov Rasshua measured 40-kn winds. By 0000 on the 9th the storm was 982 mb southwest of Ostrov Beringa. Some wind reports south and southwest of the center had increased to strong gales with waves up to 20 ft. On the 10th the POLLENGER and WELSH CITY both near 51°N, 164°E, had winds near 50 kn and the latter had 33-ft swells. The OGDEN FRASER also found 33-ft waves at 50°N, 168°E, on the 11th. At this time the next storm was approaching from the southwest, and this one was absorbed on the 12th.

Monster of the Month--A frontal system was moving over Japan on the 9th. At 0000 of the 10th the analysis indicated another LOW had closed around the point of occlusion near Tokyo. Later in the day two ships southwest of the center had winds over 50 kn. On the 11th the PRESIDENT TYLER (37°N, 150°E) had gales and 30-ft swells. Another ship (37°N, 155°E) at the occlusion had 41-ft swells from the south-southeast. The 12th found the PRESIDENT TRUMAN near 39°N, 157°E, with 55-kn winds and 34-ft waves. The PRESIDENT TYLER (39°N, 159°E) verified the observation with 30-ft waves. The storm was 976 mb near 45°N, 160°E.

The cyclone was pushing against a 1030-mb HIGH, but there was not the expected increase in windspeeds east of the center. Instead, the storm curved northward and disintegrated.

This storm was born near Kyushu on the 12th. By the 14th there were a few gale reports and waves of 20 ft. At 2200 on the 14th the EASTERN WORLD (48°N, 164°E) took a special observation when she measured 65-kn winds, 17-ft seas, and crushing 52-ft swells. On the 15th the SOUTHERN HIGHWAY (49°N, 162°E) found 60-kn winds and a Soviet ship at 51°N, 158°E, found only 2 kn less. The PACIFIC VENTURE (51°N, 166°E) north of the storm had 30-ft swell waves out of the east. There were still some 50-kn reports on the 16th, and the EASTERN TREASURER (48°N, 160°E) had westerly 41-ft swells. Others were finding 20- to 30-ft waves. At 0000 the storm was centered at 50°N, 163°E, at 970 mb, but it started weakening rapidly as another storm approached from the southwest.

The Yellow Sea produced this cyclone. It moved across Tokyo Bay, and the HIRO MARU (34°N, 146°E) reported 55-kn winds. The 17th found the PRESIDENT JEFFERSON (37°N, 148°E) with 50-kn winds and 25-ft waves.

Later the TITAN (36°N, 155°E) had 33-ft waves on her bow. The stronger winds were generally strong gales on the 18th with several finding waves over 20 ft and one near 38°N, 174°E, 33-ft swells. By 0000 on the 19th the storm was 962 mb near 50°N, 175°W. The Pacific High had retreated to its usual position. The SEA-LAND INNOVATOR (47°N, 177°W) measured 65-kn winds and 30-ft swell waves. The WEST JINORIWON (45°N, 172°W) found 66-kn southeasterly winds and 33-ft waves. The NEW INDEPENDENCE at 45°N, 179°W, had westerly 57-kn winds and 39-ft waves.

The storm was traveling northeastward over the Alaska Peninsula on the 20th and 21st. The winds were gale force or less, but there were still a few wave reports of over 20 ft. The storm was weakening and finally disappeared on the 23d.

Another storm from the Yellow Sea. At 0000 on the 20th it was over the Sea of Japan, but there were gales and 20-ft seas east of Japan. The YOUNG SPLENDOR (35°N, 146°E) had 57-kn southerly winds with 36-ft waves. Twelve hours later the winds had quieted, but the swells were still 33 ft. The storm was 984 mb near 49°N, 173°E, on the 22d. The significant weather was 20-ft waves. There was a 45-kn wind report west of the center on the 23d. On the 26th a frontal wave was moving through the southern periphery, leaving a strong gradient only on the north side of the storm. The SPRAY CAP was in that quadrant with 58-kn winds. The storm stalled near 51°N, 155°W, and dissipated on the 28th as the frontal wave continued to the east.

The Gulf of Alaska was relatively quiet this month, until this storm came along. It formed as a frontal wave northeast of Hawaii between two high-pressure cells. At 0000 on the 30th it was 986 mb near 49°N, 142°W (fig. 61). Ocean Weather Station Papa, a few miles to the west, had 45-kn winds from the north and 23-ft waves. The DIAMOND PHOENIX (51°N, 142°W) was carrying 58-kn winds, 992 mb, and 20-ft waves. At 0600 Papa measured 48-kn winds and 33-ft waves as did another ship 3° latitude to the north. On May 1 buoy 46004 measured 20-ft waves. The storm stalled against the beach on the 2d and fell apart.

Tropical Cyclones, Western North Pacific--Tropical storm Gerald developed among the Caroline Islands on the 15th. Moving west-northwestward from Satawan Atoll, the tropical storm crossed the 145th meridian before recurving northward. At this time, early on the 17th, winds reached a peak of 55 kn. Gerald maintained 50- to 55-kn winds as he skirted the southern Mariana Islands on the 18th. The following day he weakened rapidly as surface pressure rose to 1003 mb.

Two weeks after Gerald came to life, tropical storm Holly popped up just northwest of Lele Island in the Caroline Islands. On a west-northwestward track, Holly crossed the 155th meridian on May 1. By the 2d, generating maximum winds of 45 kn, she moved north of the 10th parallel near 150°E. Soon after this crossing, Holly began to slow and weaken. Vertical wind shear resulting from a strong westerly upper level flow was a factor in her demise on the 7th.

Casualties--The bulkcarrier AMSTELMOLEN was due Asano dock on the 6th with weather damage. On the 9th the 6,888-ton submarine GEORGE WASHINGTON collided with the 2,350-ton NISSHO MARU off Kagoshima in rain and fog. The NISSHO MARU sank within 15 min. Two crewmen were missing, but 13 were rescued. The YUNAM No. 7 (1,592 tons) sank after a collision in fog with the 3,350-ton LUCKY No. 3 off Anmo Do, South Korea, on the 12th. The crew was rescued by LUCKY No. 3.

The AEGIS LOGIC was at Sasebo on the 20th with heavy-weather damage. The cargo shifted in heavy weather on the 21st on the JAPAN CANELA, Yokohama to Los Angeles. The 2,828-ton BALTIK collided in strong winds with the EISHIN MARU in Yokohama anchorage on the 20th.

The American ferry WALLA WALLA on Puget Sound grounded in fog on the 23d. The FUHWO VENTURE was due Nagoya on the 25th with weather damage. The LIECHTENSTEIN sustained weather damage on the 25th.

Other Casualties--The Greek motor vessel JADE had heavy-weather damage during the period April 1 to 12 from Australia to Chile. The fishing vessel JUI MAN No. 3 grounded in a heavy rain squall and swells near 14.3°N, 170.6°W, on the 8th. The SILVERHAWK sustained weather damage on the 12th from Hobart to Melbourne. The SOUTHERN DIAMOND at Santiago, Chile, reported damage from the 25th and 26th. The tanker AMANDA MILLER reported weather damage at Kwinana.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

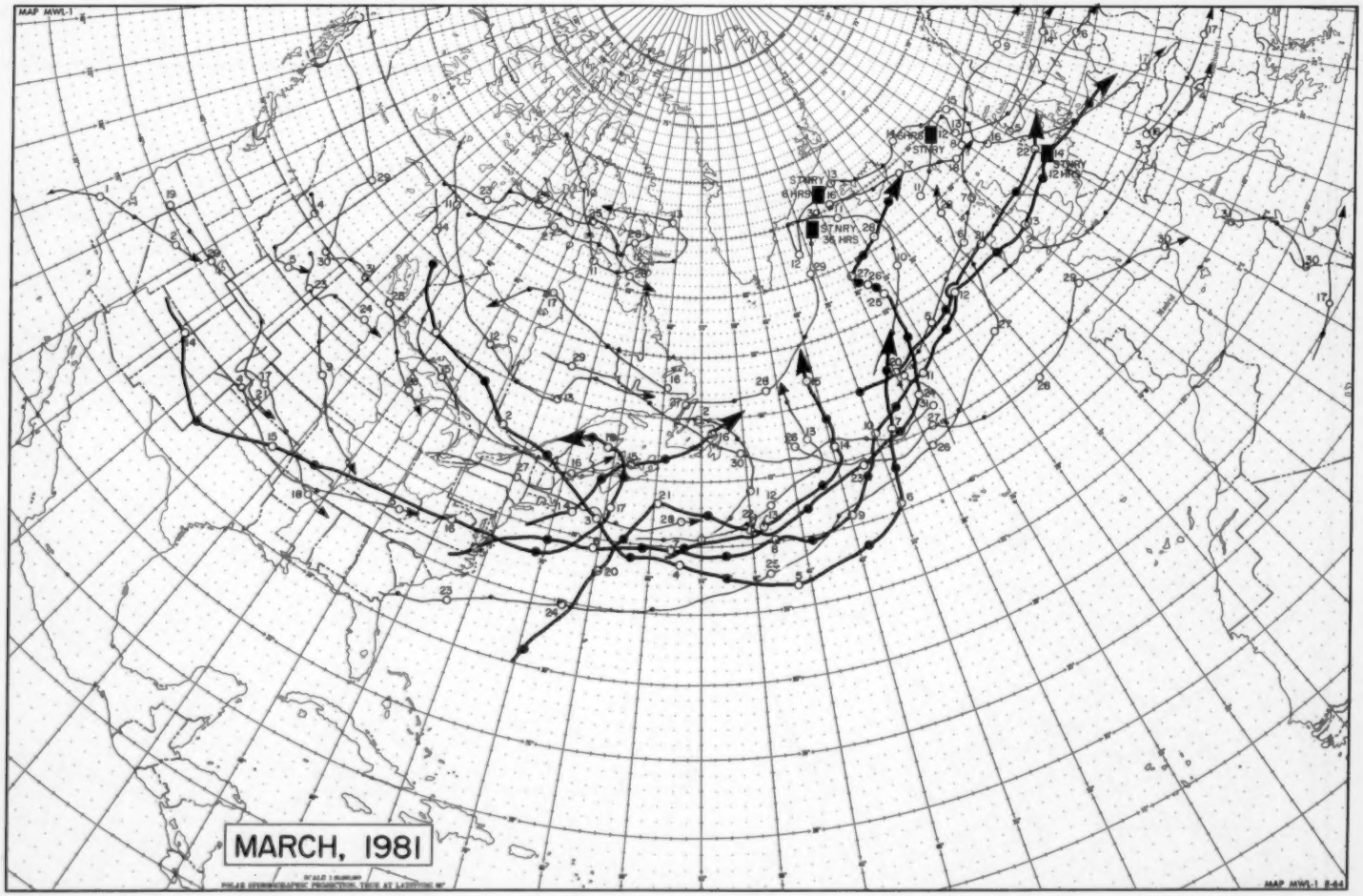


Figure 36.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

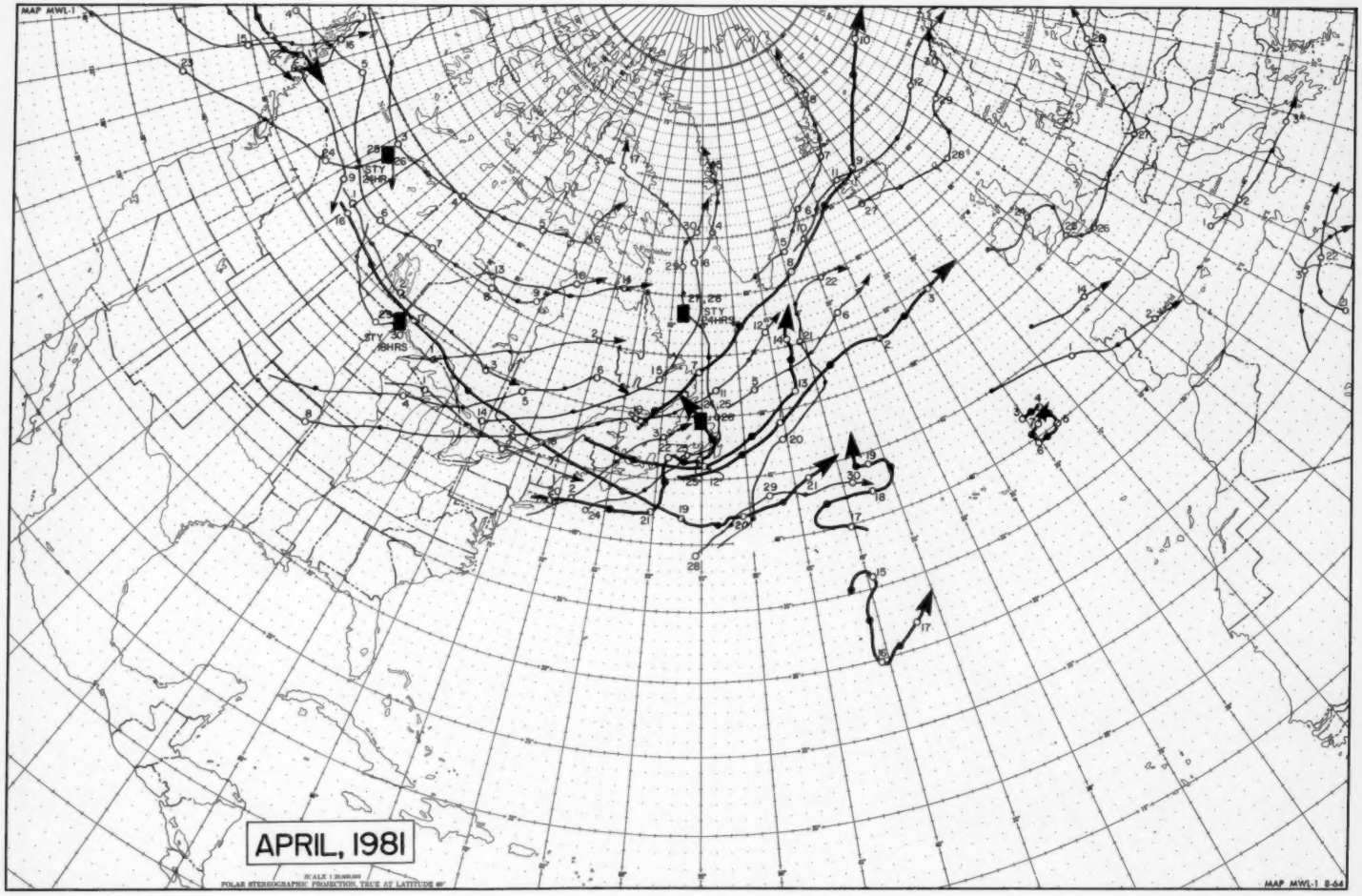


Figure 37.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

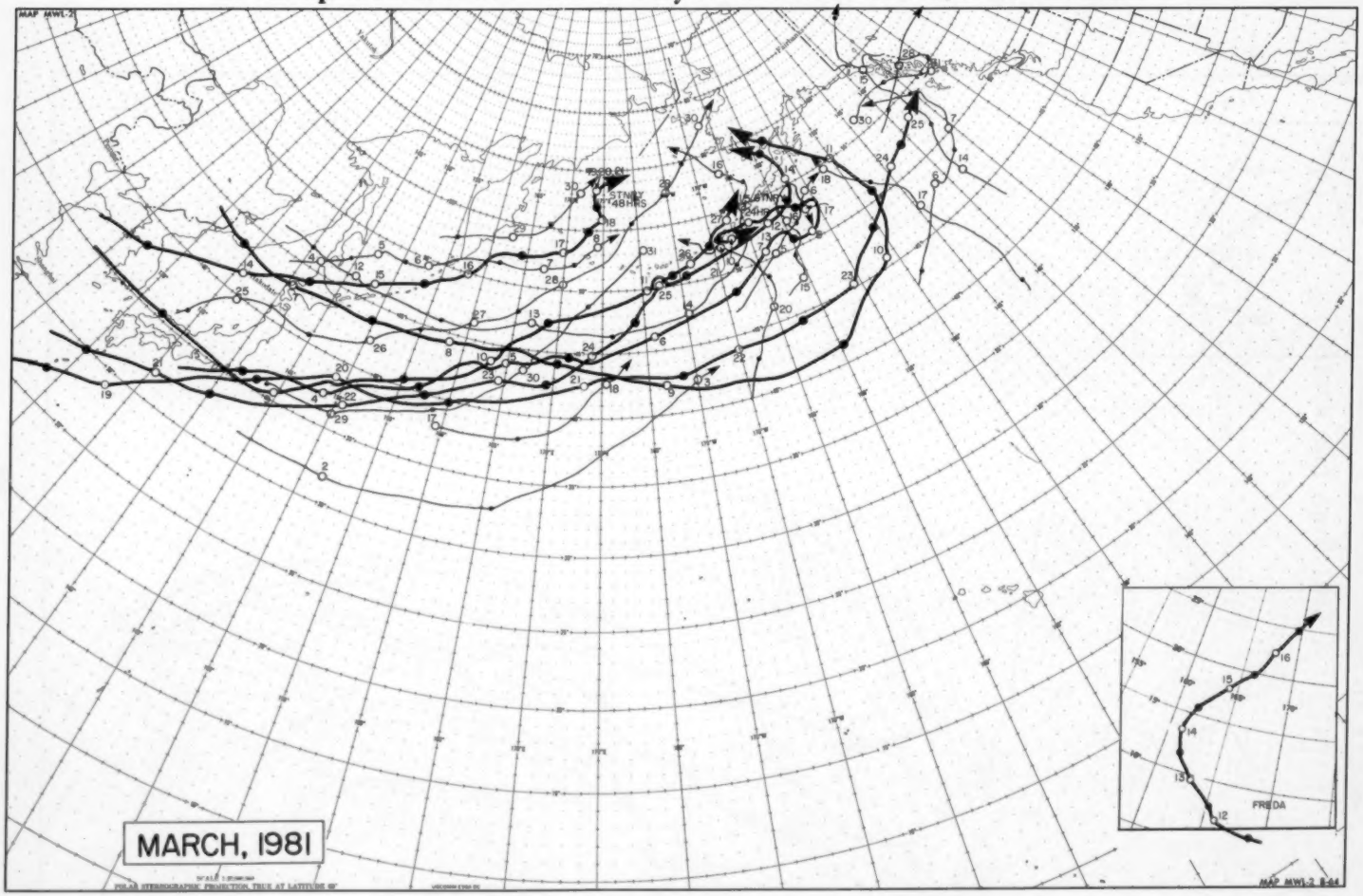


Figure 38.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

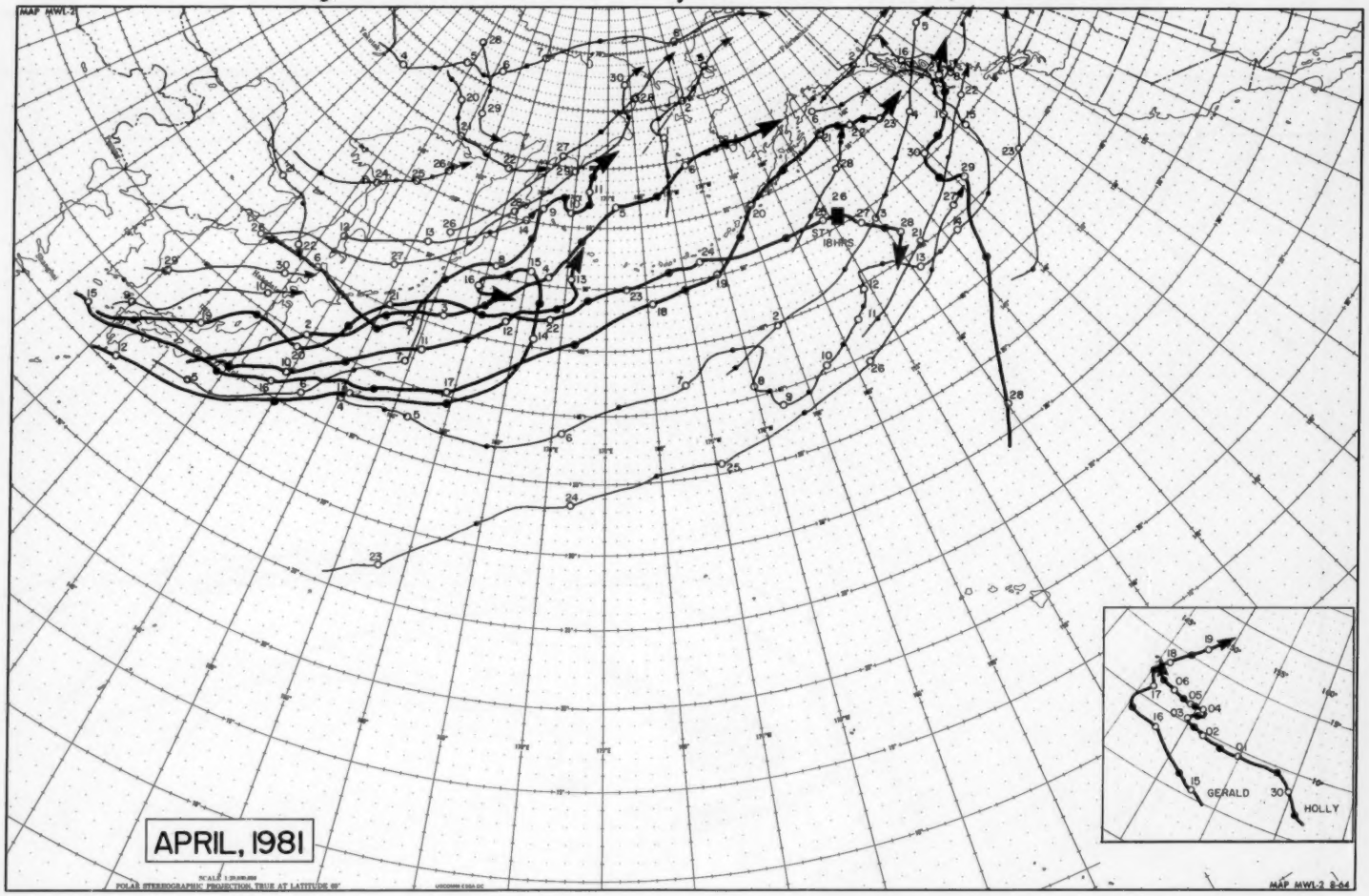


Figure 39. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

U.S. Ocean Buoy Climatological Data

March and April 1981

MARCH 41001

DATA SUMMARY

AVERAGE LATITUDE 34.7N AVERAGE LONGITUDE 072.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	09.1	(20 21)	15.8	21.2	(31 21)	246	31
SEA TEMP (DEG C)	18.8	(30 12)	20.1	22.4	(14 21)	246	31
AIR-SEA TEMP (DEG C)	-12.0	(20 21)	-04.3	01.4	(01 15)	246	31
PRESSURE (MBAR)	0989.6	(16 21)	1014.4	1031.3	(29 15)	246	31

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 203

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	16.3	25.1	29.6	30.0	3.0	.5	.5	0	2.2M	10.0M	(17 09)

MARCH 41002

DATA SUMMARY

AVERAGE LATITUDE 32.3N AVERAGE LONGITUDE 075.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	09.1	(20 21)	15.8	21.2	(31 21)	246	31
SEA TEMP (DEG C)	18.8	(30 12)	20.1	22.4	(14 21)	246	31
AIR-SEA TEMP (DEG C)	-12.0	(20 21)	-04.3	01.4	(01 15)	246	31
PRESSURE (MBAR)	0989.6	(16 21)	1014.4	1031.3	(29 15)	246	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		3.7	6.1	2.5			12.3	16.4
NE			1.2				1.2	12.7
E		.8	2.0	1.2	.4		4.5	18.2
SE	.4	.4	.8				1.6	9.5
S	.4	.8	7.0	4.1			14.3	19.3
SW	.4	2.0	7.0	7.0	.4		16.8	19.1
W	1.2	1.2	4.1	8.2	.4		17.2	20.8
NW	1.2	4.5	10.4	7.4	.4		32.0	17.1
CALM								
TOTAL	3.7	13.5	40.8	32.4	1.6		100.0	18.2

MAX WIND SPEED: 34 KNOTS DIRECTION: 100 DEG DAY: 31 HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 246

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		21.1	42.3	21.1	13.4	1.2	.8		2.7M	8.0M	(17 09)

MARCH 41003

DATA SUMMARY

AVERAGE LATITUDE 30.3N AVERAGE LONGITUDE 080.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	10.0	(20 12)	16.9	21.4	(26 18)	223	29
SEA TEMP (DEG C)	18.2	(26 12)	19.5	22.2	(27 06)	222	29
AIR-SEA TEMP (DEG C)	-08.5	(20 12)	-02.6	02.2	(28 18)	222	29
PRESSURE (MBAR)	0997.2	(19 09)	1015.9	1026.3	(28 15)	223	29

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.3	10.8	5.4				17.5	8.7
NE	.9	1.8	.4				3.1	6.4
E	1.3	4.0	2.2				7.6	9.0
SE	.9	2.2	4.9	.4			8.5	12.3
S	.4	2.2	5.4	4.0			12.1	16.6
SW	.9	5.4	4.5	.4			11.2	11.8
W	2.2	5.4	8.1	2.7			18.4	12.7
NW		4.0	13.5	3.6			21.1	16.0
CALM	.4						.4	0
TOTAL	8.5	35.9	44.4	11.2			100.0	12.4

MAX WIND SPEED: 28 KNOTS DIRECTION: 190 DEG DAY: 05 HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 69

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	7.8	59.4	25.0	7.8					1.6M	3.5M	(05 09)

MARCH 41005

DATA SUMMARY

AVERAGE LATITUDE 31.7N AVERAGE LONGITUDE 070.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.0	(20 15)	16.0	22.0	(05 06)	246	31
SEA TEMP (DEG C)	15.0	(10 06)	19.8	22.2	(14 21)	246	31
AIR-SEA TEMP (DEG C)	-13.3	(20 12)	-03.7	02.2	(05 06)	246	31
PRESSURE (MBAR)	0995.4	(19 09)	1014.9	1028.8	(28 18)	246	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.4	4.9	6.1	.4			13.8	11.1
NE	.8	3.3	3.7				7.7	9.4
E	.4	.8	1.6				2.8	11.8
SE	.4	2.4	2.8	.8			6.5	12.1
S		4.1	2.8	3.3			10.2	15.9
SW	.4	2.8	7.3	2.4			13.0	15.6
W	.4	4.9	15.9	3.7			26.4	14.7
NW	.4	4.5	8.1	5.7			18.7	17.2
CALM	.8						.8	0
TOTAL	6.1	29.7	48.0	16.3			100.0	14.1

MAX WIND SPEED: 38 KNOTS DIRECTION: 310 DEG DAY: 28 HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 245

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	9.0	47.8	29.4	12.7	1.2				1.7M	4.0M	(23 00)

MARCH 42001

DATA SUMMARY

AVERAGE LATITUDE 25.9N AVERAGE LONGITUDE 089.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	14.4	(19 21)	20.0	23.4	(31 21)	246	31
SEA TEMP (DEG C)	19.1	(24 09)	21.0	23.1	(02 21)	246	31
AIR-SEA TEMP (DEG C)	-05.8	(11 15)	-01.0	02.2	(31 15)	246	31
PRESSURE (MBAR)	1005.1	(05 00)	1016.7	1026.0	(11 15)	246	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	6.1	5.7	.4			13.1	10.6
NE	.4	8.2	13.5				22.0	11.7
E	1.2	6.1	14.3				21.6	12.1
SE	.8	2.9	7.8	.8			12.2	13.9
S		2.9	5.3	.8			9.0	13.3
SW			1.6				1.6	16.5
W	.8	2.0	3.7	.4			6.9	12.2
NW	.4	.4	8.2	3.7			12.7	18.1
CALM	.4						.4	.0
TOTAL	5.3	28.6	60.0	6.1			100.0	12.9

MAX WIND SPEED: 28 KNOTS DIRECTION: 300 DEG DAY: 19 HOUR: 06

APRIL 41001

DATA SUMMARY

AVERAGE LATITUDE 34.7N AVERAGE LONGITUDE 072.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	09.1	(20 21)	15.8	21.2	(31 21)	246	31
SEA TEMP (DEG C)	18.8	(30 12)	20.1	22.4	(14 21)	246	31
AIR-SEA TEMP (DEG C)	-12.0	(20 21)	-04.3	01.4	(01 15)	246	31
PRESSURE (MBAR)	0989.6	(16 21)	1014.4	1031.3	(29 15)	246	31

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 196

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	2.6	52.6	31.1	10.7	3.1				1.8M	4.5M	(14 09)

APRIL 41002

DATA SUMMARY

AVERAGE LATITUDE 32.3N AVERAGE LONGITUDE 075.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	15.3	(08 00)	19.9	23.9	(30 21)	240	30
SEA TEMP (DEG C)	19.6	(01 09)	22.1	25.0	(23 21)	240	30
AIR-SEA TEMP (DEG C)	-07.6	(22 06)	-02.2	01.6	(29 18)	240	30
PRESSURE (MBAR)	1002.5	(25 03)	1022.4	1038.9	(16 15)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	2.1	4.6	.8			7.5	14.5
NE		.4	10.8	2.5			13.0	17.4
E		5.4	7.5				13.0	10.9
SE	.8	5.9	4.3				12.6	11.1
S	1.3	2.1	12.6	1.3			17.2	13.7
SW	.8	4.6	16.7	1.7			23.4	14.8
W		.8	4.6	1.3			6.7	14.3
NW		2.1	4.2	.4			6.7	14.3
CALM	.8						.8	.0
TOTAL	2.9	23.0	66.5	7.5			100.0	14.0

MAX WIND SPEED: 30 KNOTS DIRECTION: 260 DEG DAY: 23 HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	.4	68.3	22.9	5.8	2.5				1.7M	5.0M	(25 09)

APRIL 41003

DATA SUMMARY

AVERAGE LATITUDE 30.5N AVERAGE LONGITUDE 080.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	16.3	(06 18)	21.4	24.0	(30 00)	238	30
SEA TEMP (DEG C)	18.7	(01 12)	21.5	23.9	(26 21)	238	30
AIR-SEA TEMP (DEG C)	-04.0	(25 18)	-00.1	01.8	(05 06)	238	30
PRESSURE (MBAR)	1007.6	(24 21)	1021.5	1035.1	(16 15)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.3	5.0	3.8				10.1	9.6
NE	1.3	1.3	4.2	.4			7.1	11.9
E	.8	5.9	10.9	.4			18.1	11.9
SE	1.7	7.1	5.9				14.7	9.6
S	.8	12.6	7.1				20.6	8.9
SW	1.3	6.3	5.5				13.0	8.8
W	.8	4.7	3.4				10.9	9.2
NW		2.1	2.5				4.6	11.2
CALM	.8						.8	.0
TOTAL	8.8	47.1	43.3	.8			100.0	9.9

MAX WIND SPEED: 23 KNOTS DIRECTION: 330 DEG DAY: 22 HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 78

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	48.6	47.1	4.3						.9M	2.5M	(22 18)

APRIL 41005

DATA SUMMARY

AVERAGE LATITUDE 31.7N AVERAGE LONGITUDE 070.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	16.9	(06 18)	20.8	24.7	(29 00)	238	30
SEA TEMP (DEG C)	17.0	(02 06)	21.3	25.0	(26 06)	238	30
AIR-SEA TEMP (DEG C)	-05.8	(25 21)	-00.5	02.5	(13 06)	238	30
PRESSURE (MBAR)	1009.1	(24 21)	1021.1	1034.2	(16 15)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.7	1.7	1.7	.4			5.5	9.6
NE	.8	4.2	3.8	3.8			12.6	14.2
E		1.7	9.2	.8			11.8	14.6
SE	.4	3.4	3.4				7.1	10.1
S	1.7	4.6	9.7				16.0	11.4
SW	2.1	8.4	15.1	.8			26.5	12.8
W	.4	3.8	10.1	.8			15.1	13.1
NW	1.3	1.7	1.3	.4			4.6	9.3
CALM	.8						.8	.0
TOTAL	9.2	29.4	59.2	7.1			100.0	12.1

MAX WIND SPEED: 27 KNOTS DIRECTION: 040 DEG DAY: 21 HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 230

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	7.1	75.6	16.9	5.5	.8				1.4M	4.0M	(22 00)

APRIL 42001

DATA SUMMARY

AVERAGE LATITUDE 25.9N AVERAGE LONGITUDE 089.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	19.7	(07 09)	23.4	27.6	(30 21)	240	30
SEA TEMP (DEG C)	21.3	(07 12)	23.6	28.2	(30 21)	240	30
AIR-SEA TEMP (DEG C)	-02.6	(21 00)	-00.2	01.6	(01 21)	240	30
PRESSURE (MBAR)	1011.5	(25 00)	1019.4	1028.9	(06 15)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.3		4.2	3.9			11.7	17.8
NE		3.9	9.1	2.6			15.6	15.8
E		19.5	28.6				48.1	11.3
SE	1.3	3.9	13.0	2.6			20.4	13.1
S								
SW								
W								
NW		1.3					1.3	9.8
CALM	2.6						2.6	.0
TOTAL	5.2	28.6	57.1	9.1			100.0	12.6

MAX WIND SPEED: 29 KNOTS DIRECTION: 120 DEG DAY: 04 HOUR: 09

MARCH 42002

DATA SUMMARY

AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 093.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	14.8	(19 18)	20.0	23.0	(05 15)	245	31
SEA TEMP (DEG C)	21.1	(15 15)	21.7	22.4	(30 21)	245	31
AIR-SEA TEMP (DEG C)	-07.0	(19 18)	-01.7	01.1	(31 21)	245	31
PRESSURE (MBAR)	1004.6	(22 00)	1017.3	1027.5	(10 18)	245	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.2	6.1	5.3	.9			13.1	10.6
NE	.8	6.1	6.1	.8			13.9	12.5
E		9.6	12.7	.9			22.6	12.0
SE	2.0	7.3	13.5	1.6			24.5	12.7
S	.9	4.1	6.5	.9			11.4	12.2
SW	.9	.8	.8	.9			2.6	12.2
W		.9	2.9				3.3	13.0
NW	.8	.8	5.3	1.6			8.6	15.6
CALM	.9						.9	.0
TOTAL	6.1	35.1	53.1	5.7			100.0	12.4

NO. OF OBS: 245

MAX WIND SPEED: 27 KNOTS DIRECTION: 330 DEG DAY: 19 HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 245

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	22.9	48.2	24.5	4.9					1.4M	3.6M (23 06)

MARCH 42003

DATA SUMMARY

AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 086.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	18.4	(19 21)	21.1	23.4	(31 21)	246	31
SEA TEMP (DEG C)	21.3	(06 03)	23.3	25.3	(15 21)	246	31
AIR-SEA TEMP (DEG C)	-06.3	(19 21)	-02.2	01.7	(06 00)	246	31
PRESSURE (MBAR)	1004.8	(19 00)	1016.1	1025.0	(10 15)	246	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		5.7	5.7				11.4	11.1
NE		7.3	11.8				19.1	11.0
E	.9	6.5	8.9	2.4			18.3	12.8
SE		4.5	6.9	1.6			13.0	14.0
S	.9	5.7	7.3	.8			14.2	11.9
SW		.8	4.9	.9			6.1	16.7
W		1.2	3.3	1.2			5.7	16.2
NW		2.0	5.3	4.9			12.2	18.3
CALM								
TOTAL	.8	33.7	54.1	11.4			100.0	13.4

NO. OF OBS: 246

MAX WIND SPEED: 27 KNOTS DIRECTION: 120 DEG DAY: 29 HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 246

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	22.8	45.9	13.8	12.2	5.3				1.5M	4.5M (23 21)

MARCH 42007

DATA SUMMARY

AVERAGE LATITUDE 30.1N AVERAGE LONGITUDE 088.9W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.1	(19 15)	15.3	21.5	(30 18)	244	31
SEA TEMP (DEG C)	14.4	(09 12)	16.0	20.2	(30 21)	245	31
AIR-SEA TEMP (DEG C)	-08.4	(19 15)	-00.6	03.9	(04 18)	244	31
PRESSURE (MBAR)	997.5	(18 21)	1016.7	1028.7	(09 15)	245	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.2	2.0	8.2	1.2			12.7	12.7
NE		3.7	8.2				11.9	12.0
E	1.6	8.2	9.0	.9			19.3	10.7
SE		5.7	3.3	.8			10.7	9.6
S		8.2	1.6	.8			10.7	9.6
SW	.9	5.3	3.7	.9			9.8	11.0
W		5.7	4.9	.9			11.5	12.1
NW	1.2	2.9	6.6	2.0			12.7	14.5
CALM	2.0						2.0	.0
TOTAL	6.6	41.8	45.5	6.1			100.0	11.5

NO. OF OBS: 244

MAX WIND SPEED: 32 KNOTS DIRECTION: 320 DEG DAY: 09 HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 74

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	70.7	20.3							.5M	1.0M (08 18)

MARCH 42008

DATA SUMMARY

AVERAGE LATITUDE 28.7N AVERAGE LONGITUDE 095.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.2	(19 12)	16.0	20.0	(05 03)	245	31
SEA TEMP (DEG C)	14.1	(01 18)	16.7	18.1	(31 21)	245	31
AIR-SEA TEMP (DEG C)	-07.3	(19 12)	00.4	04.7	(05 03)	245	31
PRESSURE (MBAR)	1001.7	(22 00)	1016.6	1029.3	(09 18)	245	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		3.7	10.2	.8			14.6	13.7
NE		4.5	11.0				15.4	11.8
E		10.6	8.1				18.7	10.9
SE	.8	4.9	12.6				18.3	12.0
S	.9	6.9	4.5				11.8	9.5
SW		4.5	4.5				8.9	10.0
W		.8	1.2				2.0	11.2
NW	.9	2.8	3.7	2.8			9.8	16.0
CALM								
TOTAL	1.6	38.6	56.1	3.7			100.0	11.9

NO. OF OBS: 246

MAX WIND SPEED: 26 KNOTS DIRECTION: 310 DEG DAY: 22 HOUR: 18

MARCH 42009

DATA SUMMARY

AVERAGE LATITUDE 29.3N AVERAGE LONGITUDE 087.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
SEA TEMP (DEG C)	18.4	(09 09)	20.0	21.3	(02 12)	245	31
PRESSURE (MBAR)	0998.8	(18 21)	1016.8	1027.9	(10 18)	245	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.9	11.4	7.8	.8			20.9	10.0
NE	.8	6.5	6.1				13.5	9.9
E	1.6	4.5	2.4				8.6	8.2
SE	1.2	4.1	7.0				13.1	11.2
S	.8	6.5	4.9				12.2	9.8
SW	.9	2.9	5.3	.9			9.0	12.6
W	.9	2.0	6.5	1.2			10.2	14.5
NW	.9	2.9	8.2	1.2			12.7	15.2
CALM	.9						.9	.0
TOTAL	6.5	40.6	49.0	3.7			100.0	11.3

NO. OF OBS: 245

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 245

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	40.8	34.3	18.7	6.2					1.2M	3.5M (23 06)

APRIL 42002

DATA SUMMARY

AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 093.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	20.0	(25 18)	22.9	25.2	(30 21)	240	30
SEA TEMP (DEG C)	21.2	(02 15)	23.3	25.5	(30 21)	240	30
AIR-SEA TEMP (DEG C)	-04.4	(25 18)	-00.3	00.9	(05 12)	240	30
PRESSURE (MBAR)	1010.4	(04 09)	1019.1	1026.6	(06 18)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.9		1.3	.9			2.1	16.6
NE		1.7	3.8	.9			5.8	14.4
E	1.3	9.6	32.9	.9			44.2	11.9
SE		16.3	30.8				47.1	11.8
S	.9		.9				.8	8.0
SW								
W								
NW								
CALM								
TOTAL	2.1	27.5	69.2	1.3			100.0	12.1

NO. OF OBS: 240

MAX WIND SPEED: 26 KNOTS DIRECTION: 060 DEG DAY: 25 HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	17.5	76.7	5.4	.4					1.2M	3.0M (26 00)

APRIL 42003

DATA SUMMARY

AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 086.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	20.3	(07 00)	24.1	26.6	(24 18)	240	30
SEA TEMP (DEG C)	23.9	(20 12)	25.8	28.2	(30 21)	240	30
AIR-SEA TEMP (DEG C)	-05.3	(07 00)	-01.7	01.1	(01 15)	240	30
PRESSURE (MBAR)	1011.7	(25 00)	1019.9	1026.7	(16 18)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.1	1.7	1.3	.9			5.9	8.0
NE	.9	2.5	6.7	.8			10.4	13.4
E	3.8	14.7	38.8				59.2	11.8
SE	1.3	6.3	6.3				13.8	10.3
S	.8	4.2	.9				5.9	6.0
SW	.8						.8	2.0
W		1.7					1.7	5.0
NW	.8	.8					1.7	2.8
CALM	1.7						1.7	.0
TOTAL	11.7	33.8	53.3	1.3			100.0	10.7

NO. OF OBS: 240

MAX WIND SPEED: 23 KNOTS DIRECTION: 030 DEG DAY: 06 HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	35.0	52.1	12.9						1.1M	2.5M (07 21)

APRIL 42007

DATA SUMMARY

AVERAGE LATITUDE 30.1N AVERAGE LONGITUDE 088.9W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	17.4	(06 15)	21.2	24.3	(23 18)	178	29
SEA TEMP (DEG C)	19.7	(03 09)	22.2	26.0	(21 18)	178	29
AIR-SEA TEMP (DEG C)	-05.0	(24 12)	-01.0	02.2	(01 03)	178	29
PRESSURE (MBAR)	1012.5	(24 09)	1021.2	1029.4	(06 15)	178	29

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		2.8	5.6				8.4	12.7
NE	1.1	6.7	3.4				11.2	9.5
E	.6	15.2	21.9				37.6	11.4
SE	1.1	12.9	14.6				28.7	10.3
S	1.1	2.8	2.8				6.7	9.5
SW		.6	1.1				1.7	10.3
W	.6	2.2					2.8	6.6
NW	.6	.6	1.7				2.8	12.2
CALM								
TOTAL	5.1	43.8	51.1				100.0	10.6

NO. OF OBS: 178

MAX WIND SPEED: 21 KNOTS DIRECTION: 330 DEG DAY: 06 HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 170

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	84.1	15.9							.5M	1.5M (08 03)

APRIL 42008

DATA SUMMARY

AVERAGE LATITUDE 28.7N AVERAGE LONGITUDE 095.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	18.2	(06 09)	21.7	25.1	(30 21)	238	30
SEA TEMP (DEG C)	17.4	(02 21)	21.4	24.9	(30 21)	239	30
AIR-SEA TEMP (DEG C)	-01.7	(24 06)	00.4	03.3	(05 00)	238	30
PRESSURE (MBAR)	1007.1	(04 00)	1018.1	1029.1	(06 15)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.3	3.3	.4			5.0	13.6
NE		1.7	6.3	.8			8.8	14.2
E	1.7	14.6	20.5				36.8	10.8
SE	1.7	16.3	18.0				36.0	10.5
S		8.8	4.2				13.0	9.3
SW								
W								
NW		.4					.4	5.0
CALM								
TOTAL	3.3	43.1	52.3	1.3			100.0	10.9

NO. OF OBS: 239

MAX WIND SPEED: 32 KNOTS DIRECTION: 360 DEG DAY: 23 HOUR: 18

APRIL 42009

DATA SUMMARY

AVERAGE LATITUDE 29.3N AVERAGE LONGITUDE 087.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
SEA TEMP (DEG C)	19.8	(06 18)	21.8	25.5	(29 18)	240	30
PRESSURE (MBAR)	1011.2	(24 09)	1020.7	1029.5	(16 15)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	21	33	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	2.9	2.9				6.7	9.5
NE	.8	5.4	.8				7.1	7.8
E	.8	17.1	7.5				25.4	8.7
SE	2.5	22.5	11.7				36.7	8.8
S	1.3	6.3	.9				7.9	7.3
SW		3.8					3.8	6.4
W	1.3	7.9	.9				9.6	8.5
NW	.9	2.1	.9				2.9	7.1
CALM								
TOTAL	7.9	67.9	24.2				100.0	8.3

NO. OF OBS: 240

MAX WIND SPEED: 20 KNOTS DIRECTION: 360 DEG DAY: 06 HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	46.3	53.8							.8M	1.5M (18 06)

MARCH DATA SUMMARY 44003
AVERAGE LATITUDE 40.0N AVERAGE LONGITUDE 060.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-02.2	(15 06)	03.1	08.4	(31 03)	246	31
SEA TEMP (DEG C)	03.6	(23 12)	04.2	04.9	(03 12)	246	31
AIR-SEA TEMP (DEG C)	-02.4	(15 06)	-01.1	04.1	(31 03)	246	31
PRESSURE (MBAR)	0976.1	(17 09)	1006.4	1027.6	(29 18)	246	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
<9	10	21	33	47	>47		
N	.9	6.9	13.9	2.6		24.2	19.2
NE	1.7	1.7	5.6	1.3		10.4	13.0
E		1.3	1.7			3.0	11.0
SE		.9				.9	8.0
S		1.3	3.9			5.2	14.5
SW		3.5	7.4	.9		11.7	13.3
W	.9	7.8	10.8	5.2		24.2	14.7
NW		3.5	11.7	5.6		20.8	16.6
CALM							
TOTAL	3.0	26.0	55.0	15.2		100.0	14.5

NO. OF OBS: 231
MAX WIND
SPEED: 32 KNOTS
DIRECTION: SSE DEG
DAY: 17
HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 246

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		21.5	36.6	17.9	20.3	3.3	.4		2.0M	8.0M (15 09)

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE: .4% SEVERE: NONE #OBS: 371

MARCH DATA SUMMARY 44004
AVERAGE LATITUDE 39.0N AVERAGE LONGITUDE 070.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-00.5	(14 21)	07.5	15.4	(14 06)	245	31
SEA TEMP (DEG C)	08.9	(25 00)	10.5	17.1	(06 15)	245	31
AIR-SEA TEMP (DEG C)	-16.3	(14 21)	-07.0	03.3	(31 06)	245	31
PRESSURE (MBAR)	0977.7	(17 03)	1008.3	1029.4	(28 18)	245	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
<9	10	21	33	47	>47		
N		1.2	9.4	7.8	.8	19.2	19.8
NE		.4	2.4	1.2		4.1	16.4
E		.4	.4	.4		1.2	17.3
SE		.4	.4			.8	13.5
S	.4	.4	.4	.8		2.0	14.0
SW		.4	5.7	3.7		9.8	19.5
W		2.9	11.4	15.5	4.9	34.7	23.8
NW		1.2	13.9	11.4	1.6	28.2	21.8
CALM							
TOTAL	.4	7.3	44.1	40.8	7.3	100.0	21.4

MAX WIND
SPEED: 45 KNOTS
DIRECTION: 330 DEG
DAY: 17
HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		16.3	33.1	23.7	20.6	6.1			3.1M	7.0M (18 06)

MARCH DATA SUMMARY 44005
AVERAGE LATITUDE 42.7N AVERAGE LONGITUDE 060.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-02.6	(19 15)	03.2	08.3	(31 18)	98	13
SEA TEMP (DEG C)	04.6	(29 06)	04.9	05.8	(26 12)	98	13
AIR-SEA TEMP (DEG C)	-07.4	(19 15)	-01.7	03.2	(31 18)	98	13
PRESSURE (MBAR)	0993.4	(19 18)	1012.1	1027.7	(28 15)	98	13

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
<9	10	21	33	47	>47		
N	2.0	8.2	10.2	11.2		31.6	17.4
NE	1.0	5.1	2.0			8.2	8.4
E	1.0	3.1	2.0			6.1	10.0
SE	2.0	1.0				3.1	4.0
S			1.0	1.0		2.0	21.5
SW		2.0	15.3	10.2		27.6	18.7
W	2.0	9.1	6.1	3.1		16.3	12.3
NW		4.1	1.0			5.1	8.2
CALM							
TOTAL	8.2	28.6	37.8	25.5		100.0	14.9

MAX WIND
SPEED: 33 KNOTS
DIRECTION: 360 DEG
DAY: 28
HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 98

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	4.1	43.9	37.8	9.2	5.1				1.9M	5.0M (22 03)

MARCH DATA SUMMARY 44006
AVERAGE LATITUDE 36.3N AVERAGE LONGITUDE 075.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	00.8	(28 15)	04.1	10.5	(31 18)	237	31
SEA TEMP (DEG C)	01.3	(12 09)	05.5	08.9	(31 18)	228	31
AIR-SEA TEMP (DEG C)	-05.0	(19 15)	00.6	06.6	(31 18)	228	31
PRESSURE (MBAR)	0985.0	(16 21)	1012.5	1032.3	(28 15)	237	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
<9	10	21	33	47	>47		
N	.9	6.6	13.2	7.5		27.8	18.2
NE	.4	1.3	3.5	.4		5.7	14.4
E	.4	2.6	.4			3.5	6.4
SE	.4	1.8	1.3			3.5	9.0
S	.9	1.8	12.7	.9		16.2	14.3
SW		3.9	9.8			12.7	12.9
W	2.6	3.9	3.1			9.6	9.2
NW	.4	3.5	9.2	6.6	1.3	21.1	16.5
CALM							
TOTAL	5.7	25.4	52.2	15.4	1.3	100.0	14.6

MAX WIND
SPEED: 44 KNOTS
DIRECTION: 330 DEG
DAY: 17
HOUR: 00

MARCH DATA SUMMARY 44001
AVERAGE LATITUDE 56.0N AVERAGE LONGITUDE 148.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	01.3	(03 12)	04.8	08.5	(18 21)	246	31
SEA TEMP (DEG C)	03.4	(04 12)	04.8	06.4	(31 18)	246	31
AIR-SEA TEMP (DEG C)	-02.7	(05 15)	00.0	01.6	(18 21)	246	31
PRESSURE (MBAR)	0983.0	(28 21)	0999.8	1015.5	(19 15)	246	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
<9	10	21	33	47	>47		
N	.8	2.9	2.0	.8		6.1	11.1
NE		1.6	4.9	.8		7.3	13.9
E	.8	2.0	10.6	7.3		20.7	16.0
SE	.8	4.5	19.2	4.9		29.4	16.0
S		2.8	11.4	2.4		16.7	12.2
SW			3.3	3.5	.8	12.6	14.9
W		.4	1.6	4.5	.4	6.9	12.8
NW		.4	2.4	2.4		5.3	13.0
CALM							
TOTAL	3.3	20.7	55.5	17.5		100.0	15.2

NO. OF OBS: 244
MAX WIND
SPEED: 32 KNOTS
DIRECTION: 140 DEG
DAY: 11
HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 244

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		2.9	28.7	25.4	34.0	7.4	1.2	.4	3.7M	10.5M (05 12)

APRIL DATA SUMMARY 44003
AVERAGE LATITUDE 40.0N AVERAGE LONGITUDE 060.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	02.1	(16 09)	06.7	10.9	(29 18)	240	30
SEA TEMP (DEG C)	04.3	(01 06)	05.7	06.9	(30 21)	240	30
AIR-SEA TEMP (DEG C)	-02.3	(21 18)	00.9	05.1	(06 09)	240	30
PRESSURE (MBAR)	0990.0	(25 06)	1016.0	1035.9	(14 03)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
<9	10	21	33	47	>47		
N		2.1	5.8	.8		8.8	15.6
NE	.4	.8	3.8			5.0	12.3
E		1.7	1.7			3.3	10.3
SE		.8	4.2			5.0	14.8
S	.8	1.3	13.3	.8		16.3	15.4
SW	.4	7.1	17.1	.4		25.0	13.8
W	.4	5.4	17.1	.4		23.3	13.2
NW		2.9	7.5	2.1		12.5	16.0
CALM	.8					.8	.0
TOTAL	2.9	22.1	78.4	4.6		100.0	13.8

NO. OF OBS: 240
MAX WIND
SPEED: 34 KNOTS
DIRECTION: 180 DEG
DAY: 06
HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	.8	37.9	45.0	15.8	.4				2.0M	4.0M (06 21)

APRIL DATA SUMMARY 44004
AVERAGE LATITUDE 39.0N AVERAGE LONGITUDE 070.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	01.5	(21 21)	09.0	14.9	(29 12)	240	30
SEA TEMP (DEG C)	07.2	(12 03)	08.7	13.2	(01 15)	239	30
AIR-SEA TEMP (DEG C)	-04.2	(21 21)	01.2	06.3	(29 12)	239	30
PRESSURE (MBAR)	0991.3	(25 00)	1018.3	1036.7	(15 12)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
<9	10	21	33	47	>47		
N			.8	.8		1.3	10.0
NE		.4	1.7	4.2		6.3	15.1
E			2.5			2.5	15.4
SE			2.1			2.1	15.8
S		9.8	9.6	2.1		17.5	13.9
SW	.4	7.9	15.4	1.7		25.4	12.2
W		7.1	19.3	3.8		29.2	15.3
NW		4.2	5.4	0.3		15.8	17.5
CALM							
TOTAL	.4	29.4	55.8	10.3		100.0	15.6

MAX WIND
SPEED: 50 KNOTS
DIRECTION: 290 DEG
DAY: 07
HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 239

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	11.8	39.9	41.2	6.7	.4				1.7M	4.0M (06 15)

APRIL DATA SUMMARY 44005
AVERAGE LATITUDE 42.7N AVERAGE LONGITUDE 060.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	01.2	(15 15)	06.0	09.0	(05 18)	126	17
SEA TEMP (DEG C)	05.3	(21 15)	05.5	08.2	(28 18)	240	30
AIR-SEA TEMP (DEG C)	-04.3	(15 15)	00.6	03.6	(05 18)	126	17
PRESSURE (MBAR)	0990.4	(02 15)	1014.3	1037.0	(19 03)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
<9	10	21	33	47	>47		
N		2.7	2.7	1.8		7.3	16.3
NE		1.8	3.2			5.0	11.4
E		.5	.5			.9	10.0
SE	.5	.5	2.3	.9		4.1	14.7
S	.9	2.7	6.8	4.1	.5	15.0	17.2
SW	.5	4.5	14.2	2.2		27.3	17.1
W		5.0	13.2	5.0	.5	23.6	16.6
NW		2.3	5.0	9.5		16.8	20.9
CALM							
TOTAL	1.8	20.0	47.7	29.5	.9	100.0	17.1

MAX WIND
SPEED: 33 KNOTS
DIRECTION: 290 DEG
DAY: 02
HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 238

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	12.2	42.0	33.6	10.9	1.3				1.7M	4.0M (16 03)

APRIL DATA SUMMARY 44006
AVERAGE LATITUDE 36.3N AVERAGE LONGITUDE 075.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	06.0	(21 18)	12.9	22.6	(16 21)	239	30
SEA TEMP (DEG C)	06.4	(01 12)	11.0	15.1	(17 00)	239	30
AIR-SEA TEMP (DEG C)	-05.3	(21 18)	01.9	10.6	(16 21)	239	30
PRESSURE (MBAR)	0994.7	(24 21)	1019.3	1037.3	(16 18)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
<9	10	21	33	47	>47		
N		3.4	9.7	3.4		16.4	15.7
NE		2.5	3.8	.8		7.1	13.5
E	.4	0.2	2.1			6.7	9.2
SE	.4	3.9	2.1			6.4	9.8
S	.8	0.3	30.3	2.5		39.9	15.3
SW	.0	.8	7.1	.4		8.8	10.7
W		2.9	2.5	.8		6.3	12.8
NW		2.5	3.4	.4		6.3	12.4
CALM							
TOTAL	2.1	20.4	65.9	8.4		100.0	13.9

MAX WIND
SPEED: 29 KNOTS
DIRECTION: 340 DEG
DAY: 05
HOUR: 21

APRIL DATA SUMMARY 44001
AVERAGE LATITUDE 56.0N AVERAGE LONGITUDE 148.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	01.3	(16 06)	04.4	06.6	(30 03)	239	30
SEA TEMP (DEG C)	04.1	(03 12)	04.9	06.7	(23 03)	239	30
AIR-SEA TEMP (DEG C)	-03.7	(16 06)	-00.5	01.3	(09 21)	239	30
PRESSURE (MBAR)	0982.3	(20 03)	1009.0	1024.2	(10 09)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 0-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)
<9	10	21	33	47	>47		
N	.5	2.6	2.1			5.3	9.3
NE							
E			3.7	1.6		5.3	18.6
SE	.5	1.6	0.2			4.3	10.8
S	.5	4.2	8.4	.5		13.7	11.8
SW	.5	7.9	13.2	.5		22.1	11.8
W	2.1	8.4	13.2	3.7		27.4	13.7
NW	1.1	8.4	10.8			19.5	11.8
CALM	.5					.5	.0
TOTAL	5.8	33.2	54.7	6.3		100.0	12.4

NO. OF OBS: 190
MAX WIND
SPEED: 27 KNOTS
DIRECTION: 070 DEG
DAY: 18
HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 239

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		.4	41.2	26.1	23.4	6.3	.4		2.2M	6.0M (21 09)

MARCH — DATA SUMMARY — 46002

AVERAGE LATITUDE 42.5N — AVERAGE LONGITUDE 130.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.2	(15 12)	10.3	11.9	(11 00)	246	31
SEA TEMP (DEG C)	10.9	(31 21)	11.3	11.9	(11 00)	246	31
AIR-SEA TEMP (DEG C)	-04.0	(15 12)	-01.0	00.4	(25 00)	246	31
PRESSURE (MBAR)	0997.8	(21 00)	1016.3	1033.1	(10 18)	246	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.4	2.4	1.6			4.5	17.8
NE			2.4				2.4	13.8
E		.8		.8			1.2	17.4
SE	.8	2.0	6.5	3.7			13.0	15.1
S	.8	3.7	13.0	4.9			22.4	15.8
SW		1.2	13.4	1.6			16.3	15.3
W	.8	4.5	17.9	1.6			24.8	14.7
NW		2.0	8.1	5.3			15.4	16.9
CALM								
TOTAL	2.8	17.8	63.8	19.5			100.0	15.6

NO. OF OBS: 246

MAX WIND SPEED: 31 KNOTS DIRECTION: 160 DEG DAY: 14 HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 246

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		9.3	20.7	30.1	41.9	2.0			3.5M	7.0M	(07 15)

MARCH — DATA SUMMARY — 46003

AVERAGE LATITUDE 52.0N — AVERAGE LONGITUDE 156.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N			2.0	2.4			4.5	10.7
NE		.4		1.2			1.6	11.8
E			1.6	1.6	2.0	1.6	6.8	22.7
SE			1.2	2.0	2.4	3.7	11.0	23.7
S			2.8	9.3	12.2	.4	24.8	21.5
SW		.4	1.6	10.2	10.2	1.6	24.0	21.3
W		.4	2.4	6.9	11.4	1.6	22.8	22.1
NW		.4	1.6	2.0	.4		4.5	12.7
CALM								
TOTAL		1.6	13.4	37.4	38.6	8.9	100.0	20.9

NO. OF OBS: 246

MAX WIND SPEED: 46 KNOTS DIRECTION: 250 DEG DAY: 04 HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 232

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		2.2	11.6	34.1	40.1	9.5	.9	1.7	4.1M	19.5M	(16 12)

MARCH — DATA SUMMARY — 46004

AVERAGE LATITUDE 51.0N — AVERAGE LONGITUDE 136.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	02.2	(04 09)	06.7	08.5	(11 15)	246	31
SEA TEMP (DEG C)	06.0	(06 09)	06.5	07.1	(26 03)	246	31
AIR-SEA TEMP (DEG C)	-04.1	(04 09)	-00.2	02.2	(11 03)	246	31
PRESSURE (MBAR)	0985.3	(07 15)	1007.7	1025.2	(17 00)	246	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.8	2.4	3.3	.4		6.9	10.8
NE		.4	2.8	2.0			5.3	9.0
E		.8	5.3	8.1	2.4		14.6	14.1
SE			2.4	5.3	8.9	.8	17.5	21.7
S			2.4	12.6	5.7		20.7	17.2
SW		.4	1.6	9.8	2.0		13.8	16.8
W			.4	7.7	3.3		11.4	17.5
NW			.4	6.9	2.0		9.8	16.8
CALM								
TOTAL		2.4	16.3	53.7	24.8	.8	100.0	16.6

NO. OF OBS: 246

MAX WIND SPEED: 34 KNOTS DIRECTION: 130 DEG DAY: 26 HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 246

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		4.5	11.8	29.7	48.8	5.3			3.9M	7.5M	(18 03)

MARCH — DATA SUMMARY — 46005

AVERAGE LATITUDE 46.0N — AVERAGE LONGITUDE 131.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.8	(04 21)	08.8	10.5	(11 00)	246	31
SEA TEMP (DEG C)	07.8	(29 06)	09.2	09.6	(11 00)	236	31
AIR-SEA TEMP (DEG C)	-03.6	(04 21)	-00.4	01.7	(24 00)	235	31
PRESSURE (MBAR)	0996.2	(21 15)	1012.8	1029.9	(10 21)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N								
NE								
E								
SE								
S								
SW			2.5	20.0			22.5	15.1
W			2.5	47.5			50.0	14.7
NW				27.5			27.5	18.0
CALM								
TOTAL			5.0	95.0			100.0	15.7

NO. OF OBS: NO

MAX WIND SPEED: 21 KNOTS DIRECTION: 240 DEG DAY: 31 HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 243

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		6.2	18.1	27.2	40.1	2.5			3.6M	7.0M	(07 12)

MARCH — DATA SUMMARY — 46010

AVERAGE LATITUDE 46.2N — AVERAGE LONGITUDE 124.2W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	09.4	(17 15)	09.9	10.6	(01 00)	243	31
SEA TEMP (DEG C)	08.4	(05 09)	09.9	11.2	(10 00)	243	31
AIR-SEA TEMP (DEG C)	-04.6	(17 15)	-00.6	03.9	(01 00)	243	31
PRESSURE (MBAR)	1001.1	(20 12)	1017.0	1031.3	(10 21)	244	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.4	3.0	.4			3.8	7.0
NE			3.4	2.1			5.5	9.5
E		1.3	10.2	12.8			24.3	10.4
SE			2.4	8.1	.4		10.6	13.7
S		.8	7.2	11.5	1.3		20.9	12.5
SW		.4	3.0	2.1			5.5	9.8
W			6.6	9.1			14.9	11.9
NW		1.3	4.5	5.5			12.3	10.3
CALM		2.1					2.1	.0
TOTAL		6.4	41.3	50.6	1.7		100.0	11.0

NO. OF OBS: 235

MAX WIND SPEED: 24 KNOTS DIRECTION: 160 DEG DAY: 29 HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 236

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		.8	16.9	41.2	31.1	10.0			2.6M	5.0M	(08 03)

APRIL — DATA SUMMARY — 46007

AVERAGE LATITUDE 42.5N — AVERAGE LONGITUDE 130.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.1	(10 15)	10.4	13.0	(17 00)	240	30
SEA TEMP (DEG C)	10.7	(12 15)	11.3	13.2	(17 00)	240	30
AIR-SEA TEMP (DEG C)	-02.7	(12 15)	-00.9	01.3	(28 00)	240	30
PRESSURE (MBAR)	1004.8	(15 03)	1022.1	1035.8	(06 06)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.1	4.6	3.8				10.4	8.8
NE	.4	2.1					2.5	5.3
E	.8						.8	2.0
SE	.8	.4	.8				2.1	7.4
S	.4	2.9	6.7	.4			10.4	12.7
SW		2.9	6.7	.4			22.9	12.7
W		7.5	16.7	.8			25.0	13.5
NW		4.6	20.0				24.6	14.1
CALM	1.3						1.3	.0
TOTAL	5.8	20.8	63.8	1.7			100.0	12.3

NO. OF OBS: 240

MAX WIND SPEED: 23 KNOTS DIRECTION: 180 DEG DAY: 15 HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		21.7	38.3	34.6	5.4				2.5M	5.0M	(01 18)

APRIL — DATA SUMMARY — 46008

AVERAGE LATITUDE 52.0N — AVERAGE LONGITUDE 156.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		2.9	5.9				8.8	12.4
NE		2.1	2.1				4.2	12.2
E		1.7	2.5				4.2	12.7
SE		1.7	2.9	2.5			7.1	17.2
S		2.5	5.0	.4	.4		8.4	13.9
SW		.8	7.6	8.4			16.8	20.5
W		7.1	24.8	5.5			37.4	15.1
NW		5.0	6.7	1.3			13.0	13.5
CALM								
TOTAL		23.9	57.6	18.1	.4		100.0	15.4

NO. OF OBS: 238

MAX WIND SPEED: 34 KNOTS DIRECTION: 190 DEG DAY: 01 HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 216

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		36.1	31.5	24.1	7.4	1.4			2.3M	7.0M	(20 12)

APRIL — DATA SUMMARY — 46009

AVERAGE LATITUDE 51.0N — AVERAGE LONGITUDE 136.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	01.9	(11 03)	06.3	08.4	(30 00)	240	30
SEA TEMP (DEG C)	06.2	(11 15)	06.6	07.7	(29 00)	240	30
AIR-SEA TEMP (DEG C)	-04.4	(11 03)	-00.3	01.6	(30 00)	240	30
PRESSURE (MBAR)	0991.8	(30 21)	1011.7	1029.9	(06 00)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.4	3.3	5.4	.4		9.6	12.3
NE		.4	1.3				1.7	12.3
E	.4	.8	1.7	1.3			4.2	10.6
SE		.8	3.8	4.6			9.2	20.9
S		3.3	8.3	3.3			15.0	16.4
SW		4.6	13.0	2.1			16.7	16.9
W		4.6	12.5	3.3			20.4	15.5
NW		1.7	4.7	15.0			23.3	21.8
CALM								
TOTAL	.4	16.7	47.5	35.0	.4		100.0	18.1

NO. OF OBS: 240

MAX WIND SPEED: 34 KNOTS DIRECTION: 340 DEG DAY: 11 HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		9.6	28.8	30.8	30.4	.4			3.1M	6.0M	(30 18)

APRIL — DATA SUMMARY — 46005

AVERAGE LATITUDE 46.0N — AVERAGE LONGITUDE 131.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	03.6	(11 18)	08.9	11.3	(27 21)	240	30
SEA TEMP (DEG C)	08.1	(16 15)	09.5	11.4	(26 03)	237	30
AIR-SEA TEMP (DEG C)	-05.5	(11 18)	-00.6	01.6	(27 21)	237	30
PRESSURE (MBAR)	1001.5	(15 09)	1017.5	1034.3	(06 06)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	1.3		.4			2.5	7.0
NE		.4					.4	9.0
E	1.7	.8					2.5	2.7
SE	.4		2.9				3.3	13.0
S	1.3	7.1	11.7				20.0	11.1
SW	.4	5.0	16.3				21.7	13.1
W		5.4	21.3	.4			27.1	13.8
NW		1.7	18.3	.4			20.4	17.1
CALM	2.1						2.1	.0
TOTAL	6.7	21.7	70.4	1.3			100.0	13.0

NO. OF OBS: 240

MAX WIND SPEED: 26 KNOTS DIRECTION: 290 DEG DAY: 11 HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		16.3	29.2	39.6	15.0				2.8M	5.0M	(05 09)

APRIL — DATA SUMMARY — 46010

AVERAGE LATITUDE 46.2N — AVERAGE LONGITUDE 124.2W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.0	(12 00)	09.3	14.7	(30 00)	228	30
SEA TEMP (DEG C)	09.2	(04 06)	10.4	12.4	(30 21)	227	30
AIR-SEA TEMP (DEG C)	-04.5	(12 00)	-01.1	03.7	(14 21)	227	30
PRESSURE (MBAR)	1006.6	(11 12)	1019.2	1029.4	(06 09)	228	30

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 221

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		4.1	23.1	38.5	30.3	4.1			2.3M	4.5M	(28 06)

MARCH — DATA SUMMARY — 46011

AVERAGE LATITUDE 34.9N — AVERAGE LONGITUDE 120.9W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	09.3	(05 09)	12.9	15.7	(17 21)	242	31
SEA TEMP (DEG C)	11.6	(31 00)	13.6	14.7	(12 00)	242	31
AIR-SEA TEMP (DEG C)	-04.6	(05 09)	-00.7	01.4	(17 21)	242	31
PRESSURE (MBAR)	1003.6	(01 12)	1016.2	1023.9	(22 18)	242	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	11	22	33	47 >47	TOTAL %	MEAN SPEED (KNOTS)
N	1.2	5.4	9.1	.4			16.2	11.5
NE	.4	1.2	1.2				2.9	8.7
E		.8	.4				1.2	8.0
SE	.4	1.7	4.6	.8			7.5	14.7
S	.8	2.5	5.4				8.7	11.2
SW	.8	1.2	.8				2.9	9.7
W	.4	2.5	2.9	.4			6.2	11.4
NW	.8	11.2	33.6	5.4			51.0	14.4
CALM	3.3						3.3	.0
TOTAL	8.3	26.6	58.1	7.1			100.0	12.5

NO. OF OBS: 241

MAX WIND: SPEED: 29 KNOTS; DIRECTION: 320 DEG; DAY: 27; HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 239

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		8.7	49.4	26.8	14.7	.4			2.0M	6.0M	(05 15)

MARCH — DATA SUMMARY — 46012

AVERAGE LATITUDE 37.4N — AVERAGE LONGITUDE 122.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.7	(13 09)	11.9	14.2	(17 21)	241	31
SEA TEMP (DEG C)	12.1	(31 15)	12.7	14.1	(23 00)	241	31
AIR-SEA TEMP (DEG C)	-04.0	(13 09)	-00.7	01.7	(17 21)	241	31
PRESSURE (MBAR)	1005.6	(06 00)	1017.5	1026.5	(16 18)	241	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	11	22	33	47 >47	TOTAL %	MEAN SPEED (KNOTS)
N	1.3	7.1	3.3	.4			12.1	8.6
NE		.8	2.1				2.9	13.4
E	.4	.8					1.3	9.3
SE	1.7	2.5	3.8	1.3			9.2	11.7
S	1.7	4.7	5.0	.4			11.8	10.1
SW	1.7	4.2	.8				6.7	6.5
W	1.7	3.8	1.7	.4			7.5	8.6
NW	1.7	11.3	29.0	7.5			49.4	14.9
CALM	1.3						1.3	.0
TOTAL	11.3	37.1	41.7	10.0			100.0	11.8

NO. OF OBS: 240

MAX WIND: SPEED: 30 KNOTS; DIRECTION: 330 DEG; DAY: 05; HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 241

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	.8	13.3	43.6	25.7	15.8	.8			2.0M	5.5M	(05 03)

MARCH — DATA SUMMARY — 51001

AVERAGE LATITUDE 23.4N — AVERAGE LONGITUDE 162.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	18.4	(17 15)	21.4	23.5	(29 03)	247	31
SEA TEMP (DEG C)	23.0	(04 12)	22.6	23.9	(27 03)	247	31
AIR-SEA TEMP (DEG C)	-04.1	(17 15)	-01.0	01.3	(05 03)	247	31
PRESSURE (MBAR)	1013.7	(21 03)	1019.6	1024.7	(28 21)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	11	22	33	47 >47	TOTAL %	MEAN SPEED (KNOTS)
N	1.6	4.9	8.5	.4			15.4	11.7
NE	.4	12.6	27.5				40.5	12.5
E	1.6	10.5	24.7				36.8	12.9
SE			.4				.4	15.0
S								
SW		1.6					1.6	5.5
W	.4	.4					.8	2.5
NW	.8	.4	2.0				3.2	11.5
CALM	1.2						1.2	.0
TOTAL	6.1	30.4	63.2	.4			100.0	12.2

NO. OF OBS: 247

MAX WIND: SPEED: 24 KNOTS; DIRECTION: 360 DEG; DAY: 22; HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 247

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		10.1	52.2	33.2	4.5				2.0M	5.5M	(16 21)

APRIL — DATA SUMMARY — 42010

AVERAGE LATITUDE 29.7N — AVERAGE LONGITUDE 093.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	14.9	(05 15)	21.4	24.7	(30 21)	237	30
PRESSURE (MBAR)	1009.7	(04 03)	1018.5	1026.5	(06 15)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	11	22	33	47 >47	TOTAL %	MEAN SPEED (KNOTS)
N		2.9	4.6				7.5	12.5
NE		3.8	6.7				10.5	11.4
E		4.2	10.9				15.1	12.7
SE		6.7	10.0				16.7	11.7
S	.8	12.6	11.3				24.7	9.5
SW	1.3	5.9	8.4				15.5	10.8
W		2.5	3.3				5.9	10.6
NW	.4	.4	1.7				2.9	11.8
CALM	1.3						1.3	.0
TOTAL	3.8	30.3	56.9				100.0	11.0

NO. OF OBS: 239

MAX WIND: SPEED: 21 KNOTS; DIRECTION: 070 DEG; DAY: 23; HOUR: 21

APRIL — DATA SUMMARY — 46013

AVERAGE LATITUDE 36.2N — AVERAGE LONGITUDE 123.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.8	(14 18)	10.8	13.1	(29 03)	238	30
SEA TEMP (DEG C)	09.2	(09 21)	09.9	10.8	(01 03)	238	30
AIR-SEA TEMP (DEG C)	-01.5	(14 21)	00.9	03.1	(29 03)	238	30
PRESSURE (MBAR)	1009.6	(16 12)	1017.0	1026.9	(04 18)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	11	22	33	47 >47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	2.9	1.7				5.0	9.0
NE		.4					.4	8.0
E								
SE								
S								
SW								
W		3.4	6.7				10.1	11.9
NW	.4	5.9	42.9	34.9			84.0	19.6
CALM	.4						.4	.0
TOTAL	1.3	12.6	51.3	34.9			100.0	18.1

NO. OF OBS: 239

MAX WIND: SPEED: 33 KNOTS; DIRECTION: 310 DEG; DAY: 08; HOUR: 08

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 238

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	3.8	23.9	48.1	17.6	6.8				2.2M	5.0M	(07 06)

APRIL — DATA SUMMARY — 46011

AVERAGE LATITUDE 34.9N — AVERAGE LONGITUDE 120.9W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	09.3	(14 15)	11.7	19.9	(29 15)	240	30
SEA TEMP (DEG C)	10.0	(11 15)	11.6	14.3	(01 03)	240	30
AIR-SEA TEMP (DEG C)	-02.1	(07 00)	00.1	08.2	(29 15)	240	30
PRESSURE (MBAR)	1008.9	(29 12)	1016.8	1023.7	(04 21)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	11	22	33	47 >47	TOTAL %	MEAN SPEED (KNOTS)
N	3.3	9.2	9.6				22.1	8.9
NE	.4	1.3					1.7	9.8
E								
SE	.4						.4	1.0
S	.4						1.3	8.4
SW	.8	.4					1.3	8.7
W		2.9	.4				3.3	7.9
NW	.8	11.3	46.7	8.3			67.1	13.6
CALM	2.9						2.9	.0
TOTAL	8.8	24.3	56.7	8.3			100.0	12.9

NO. OF OBS: 240

MAX WIND: SPEED: 26 KNOTS; DIRECTION: 320 DEG; DAY: 03; HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 239

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		30.5	45.6	22.2	1.7				2.2M	4.5M	(27 06)

APRIL — DATA SUMMARY — 46012

AVERAGE LATITUDE 37.4N — AVERAGE LONGITUDE 122.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.3	(14 18)	10.6	12.9	(29 18)	240	30
SEA TEMP (DEG C)	10.2	(28 15)	10.9	12.8	(01 00)	240	30
AIR-SEA TEMP (DEG C)	-02.1	(14 18)	-00.3	01.4	(29 15)	240	30
PRESSURE (MBAR)	1011.9	(15 00)	1018.4	1027.3	(04 18)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	11	22	33	47 >47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	2.5	3.8				6.7	11.5
NE								
E	.4						.4	2.0
SE								
S		.4	.4				.8	8.6
SW		1.3					1.3	8.0
W	1.7	6.7	1.3				9.6	7.0
NW	1.7	28.4	47.5	5.8			80.4	13.3
CALM	.8						.8	.0
TOTAL	5.0	39.3	52.9	5.8			100.0	12.3

NO. OF OBS: 240

MAX WIND: SPEED: 29 KNOTS; DIRECTION: 310 DEG; DAY: 03; HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 239

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	1.7	28.2	47.9	16.0	6.3				2.2M	5.0M	(03 03)

APRIL — DATA SUMMARY — 51001

AVERAGE LATITUDE 23.4N — AVERAGE LONGITUDE 162.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	19.5	(05 12)	22.5	24.9	(27 03)	238	30
SEA TEMP (DEG C)	23.2	(13 15)	23.0	23.1	(27 03)	238	30
AIR-SEA TEMP (DEG C)	-04.3	(05 12)	-01.2	00.2	(26 18)	238	30
PRESSURE (MBAR)	1012.3	(09 03)	1019.3	1024.5	(29 21)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	11	22	33	47 >47	TOTAL %	MEAN SPEED (KNOTS)
N	1.3	2.9	3.8	.4			8.4	11.8
NE	2.1	12.6	29.0	1.3			45.0	12.6
E	.4	16.0	24.8				41.2	11.4
SE		.8					.8	7.5
S		1.7					1.7	8.0
SW		.8					.8	5.0
W		1.3					1.3	5.5
NW		.4	.4				.8	10.5
CALM								
TOTAL	3.8	36.6	58.0	1.7			100.0	11.6

NO. OF OBS: 238

MAX WIND: SPEED: 24 KNOTS; DIRECTION: 050 DEG; DAY: 30; HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 236

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		11.3	64.3	23.9	.4				2.0M	4.0M	(05 12)

APRIL — DATA SUMMARY — 45005

AVERAGE LATITUDE 41.7N — AVERAGE LONGITUDE 082.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	00.3	(21 06)	07.6	14.6	(17 21)	168	21
SEA TEMP (DEG C)	07.1	(21 12)	07.1	08.4	(21 15)	167	21
AIR-SEA TEMP (DEG C)	-08.2	(21 06)	00.5	06.4	(11 21)	167	21
PRESSURE (MBAR)	0995.6	(26 09)	1017.8	1043.7	(15 15)	168	21

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	11	22	33	47 >47	TOTAL %	MEAN SPEED (KNOTS)
N	1.2		7.2	1.2			9.6	15.1
NE		3.0	6.0	.6			9.6	12.8
E	1.8	6.6	12.7				21.1	10.6
SE		3.6	5.4				9.0	9.8
S	1.2	3.6	7.2				12.0	9.8
SW		4.8	12.0				16.9	11.9
W	1.2	2.4	6.0	.6			10.2	12.7
NW		1.2	8.4	.6			10.2	13.2
CALM	1.2						1.2	.0
TOTAL	6.6	25.3	65.1	3.0			100.0	11.6

NO. OF OBS: 166

MAX WIND: SPEED: 26 KNOTS; DIRECTION: 340 DEG; DAY: 20; HOUR: 22

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 166

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	61.4	33.7	4.8						.7M	2.0M	(22 10)

APRIL — DATA SUMMARY — 46014

AVERAGE LATITUDE 39.2N — AVERAGE LONGITUDE 124.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.1	(15 15)	10.5	13.0	(29 03)	233	30
SEA TEMP (DEG C)	09.8	(04 18)	09.9	11.9	(01 21)	233	30
AIR-SEA TEMP (DEG C)	-02.4	(15 15)	00.6	03.4	(29 03)	233	30
PRESSURE (MBAR)	1009.6	(18 12)	1018.5	1027.5	(04 21)	233	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <9	10	11	22	33	47 >47	TOTAL %	MEAN SPEED (KNOTS)
N	1.3	10.3	15.5	6.4			33.5	14.0
NE		.9					.9	9.0
E	1.3	.4					1.7	3.0
SE	.4	.9					1.3	5.0
S	.4						.4	2.0
SW	.4						.9	1.0
W								
NW	.9	9.0	38.6	13.3			61.8	16.4
CALM	.4						.4	.0
TOTAL	5.2	21.0	54.1	19.7			100.0	15.0

NO. OF OBS: 233

MAX WIND: SPEED: 32 KNOTS; DIRECTION: 340 DEG; DAY: 07; HOUR: 02

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 233

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	4-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	1.7	22.7	55.6	16.0	3.9				2.3M	5.5M	(07 03)

Selected Gale and Wave Observations, North Atlantic

March and April 1981

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves*		Swell Waves	
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.
NORTH ATLANTIC OCEAN		MAR.															
SEALAND RESOURCE	WJKD	1	47.3 N	19.5 W	00	31	45	10 NM	02	1000.5	8.9	11.1	8	16.5	30	10	19.5
OVERSEAS MARILYN	WFOB	1	48.6 N	22.5 W	00	32	M 40	10 NM	25	1010.5	8.2	11.3	6	10	32	10	32.5
RW SESLER	WQZ4220	3	31.8 N	72.8 W	12	34	M 41	5 NM	03	1000.9	16.3	17.0	3	3	29	8	10
SAN JUAN	WRSO	3	36.3 N	71.9 W	18	31	47	5 NM	02	1004.3	6.7	18.3	6	16.5	31	8	19.5
BUYER	KCAO	3	37.3 N	67.1 W	18	31	50	5 NM	27	1000.7	8.9	21.1	9	14.5	31	9	14.5
SAN JUAN	WRSO	4	37.6 N	72.2 W	00	33	48	5 NM	02	1014.0	4.4	21.1	7	19.5	33	7	19.5
OLEANDER	PJYG	4	33.0 N	65.0 W	06	29	45	10 NM	01	1006.2	13.0		9	13			
CAPE UPRIGHT	NPSA	4	36.6 N	56.2 W	11	26	M 50	2 NM	25	0979.6	10.1	20.0	5	8	29	>13	19.5
LASH ATLANTICO	WEZU	4	36.0 N	58.3 W	12	28	50	2 NM	25	0988.8	10.6	17.8	14	49	11	>13	49
BUYER	KCAO	4	35.8 N	63.8 W	12	31	48	5 NM	02	1005.8	8.9	18.3	9	19.5			
PACIFIC PEACE	H3VX	4	36.0 N	55.0 W	12	30	M 50	5 NM	29	0982.0	13.0	17.0	5	6.5	30		32.5
TFL DEMOCRACY	9VPR	4	41.9 N	62.3 W	12	30	M 45	5 NM	50	0995.6	2.0	4.1	6	13	XX		
BARBER PRIAM	GYEV	4	40.4 N	62.6 W	18	33	42	5 NM	02	0998.5	8.1	19.0	7	6.5	34	8	23
MARCONA CONVEYOR	ELDJ	5	27.0 N	58.0 W	00	26	M 45	> 25 NM	03	1010.0	22.6	22.2	6	11.5	31	13	14.5
PACIFIC PEACE	H3VX	5	35.6 N	55.6 W	00	30	M 50	5 NM	29	0986.0	12.0	17.0	5	6.5	30		32.5
BUYER	KCAO	5	35.2 N	61.8 W	00	31	48	5 NM	02	1007.5	13.2	17.8	9	23	36	6	19.5
LASH ATLANTICO	WEZU	5	34.7 N	55.8 W	00	30	40	2 NM	02	0991.5	11.7	17.2	14	49	30	>13	49
CAPE UPRIGHT	NPSA	5	35.2 N	50.7 W	06	28	M 50	5 NM	29	0980.9	15.3	20.0	5	6.5	28	9	32.5
AMOCO VOYAGER	6ZSB	5	32.7 N	51.9 W	12	28	M 43	10 NM	81	0998.0	13.0	18.0	5	10			
OVERSEAS MARILYN	WFOB	6	39.0 N	52.0 W	00	29	M 45	10 NM	02	0990.0	12.7	21.2			27	9	23
BUYER	KCAO	6	35.2 N	54.4 W	00	30	42	> 25 NM	01	1003.1	14.5	17.8	8	16.5	35	6	18
PACIFIC PEACE	H3VX	6	34.5 N	61.1 W	18	27	M 45	5 NM	29	0984.0	17.0	17.0	5	5	27		23
LASH ATLANTICO	WEZU	6	35.4 N	57.4 W	18	24	34	10 NM	02	0978.7	18.9	17.8	13	41	24	>13	41
PACIFIC PEACE	H3VX	7	34.5 N	61.5 W	00	27	M 45	5 NM	29	0987.0	12.0	17.0	5	5	27		23
AMOCO VOYAGER	6ZSB	7	33.7 N	56.2 W	00	25	M 45	10 NM	01	0989.0	17.0	17.0	5	10			
MORMACALTAIR	WMSM	7	28.9 N	60.2 W	12	30	45	5 NM	02	1001.9	19.4	22.2	6	14.5	30	8	24.5
MARIA U	5MUC	7	29.2 N	50.5 W	18	26	M 45	5 NM	02	0996.4	22.7	21.0	12	16.5	26	9	11.5
BALTIMORE TRADER	KASJ	7	35.8 N	71.8 W	18	34	45	5 NM	02	1005.2	7.2	17.8	4	10	35	7	11.5
LASH ATLANTICO	WEZU	7	35.2 N	54.6 W	18	25	50	5 NM	02	0977.0	16.1	17.2	14	52.5	25	>13	52.5
LASH ATLANTICO	WEZU	8	35.4 N	52.7 W	00	25	45	5 NM	02	0976.3	15.6	17.2	14	52.5	25	>13	52.5
BALTIMORE TRADER	KASJ	8	37.0 N	71.8 W	00	35	45	5 NM	62	1005.2	7.2	17.8	4	10	35	7	13
RESOLUTE	KFJZ	8	39.2 N	60.2 W	06	04	45	5 NM	02	0985.7	11.1	17.2	6	13	02	12	21
MORMACALTAIR	WMSM	8	30.6 N	60.8 W	06	31	45	5 NM	62	1000.0	15.6	20.5	XX	16.5	31	9	24.5
ADM WM M CALLAGHAN	KGYE	8	46.0 N	50.1 W	12	03	42	5 NM	02	1004.5	3.3	1.7	5	11.5	03	8	16.5
MORMACTIDE	KKFW	8	29.6 N	51.1 W	18	29	40	5 NM	01	0995.5	21.0	21.1	4	5	29	10	37.5
GREEN HARBOUR	KIRJ	8	33.8 N	45.6 W	18	25	45	5 NM	64	0980.0	18.0	18.8	XX		25	>13	28
MARIA U	5MUC	8	29.1 N	51.3 W	18	27	M 42	.5 NM	81	0995.8	19.3	22.0	12	29.5	28	13	19.5
LASH ATLANTICO	WEZU	9	38.1 N	50.4 W	00	35	45	5 NM	02	0982.7	11.1	17.2	14	41	35	>13	41
SEALAND SALLOWAY	KHLX	9	47.7 N	41.8 W	06	36	48	1 NM	62	0978.0	4.4	8.8	2	29.5			
SILVERPLANA	5MWR	9	38.5 N	51.2 W	06	35	47	1 NM	81	0993.0	11.0	14.0	10	19.5	36	>13	26
IVAN TOPIC	SLWQ	9	37.1 N	33.9 W	12	22	50	5 NM	02	0984.0	18.0	19.0	12	19.5			
GREEN HARBOUR	KIRJ	9	33.6 N	48.6 W	12	31	40	10 NM	01	0995.8	15.6	17.2	4	8	31	7	34.5
DOCTOR LYKES	KMNB	10	45.5 N	36.5 W	18	28	60	1 NM	65	0967.5	7.7	14.4	6	19.5	28	6	18
AMERICAN ACCORD	KFEZ	11	48.6 N	22.5 W	16	20	50	2 NM	07	0978.8	11.7	11.2	9	36			
CHERRY VALLEY	WIRK	11	31.0 N	68.8 W	18	03	48	10 NM	00	1016.6	17.3	17.7	2	5	34	6	8
CHEVRON EDIMBURGH	A8II	13	57.2 N	13.4 W	12	32	M 50	.5 NM	25	0993.2	11.0	8.9					
MEONIA	0XON	13	36.6 N	44.4 W	18	25	M 50	10 NM	25	1003.2	15.9	17.0	9	13			
MEONIA	0XON	14	37.1 N	42.9 W	00	29	M 52	5 NM	25	1000.6	15.0	17.0					
AMERICAN RACER	KNDF	14	46.0 N	47.5 W	06	32	55	5 NM	02	0995.6	1.1	3.3	5	10	32	9	16.5
AMERICAN ACCORD	KFEZ	14	47.0 N	46.1 W	12	31	42	5 NM	62	0992.2	1.6	3.8	9	36			
TAMPA	JXNO	14	37.6 N	69.8 W	18	32	45	2 NM	28	1000.1	8.0	23.0		10	32		23
SAN JUAN	WRSO	14	35.7 N	71.7 W	18	32	45	10 NM	03	1006.6	9.4	19.4	2	10	32	8	13
SEALAND LEADER	WSNH	14	48.4 N	31.4 W	18	12	M 45	5 NM	07	0990.3	12.0	12.0	5	11.5	12	6	11.5
MEONIA	0XON	15	38.2 N	33.8 W	00	29	M 50	10 NM	02	1010.0	15.4						
OVERSEAS MARILYN	WFOB	15	36.7 N	58.0 W	00	20	M 55	5 NM	81	0999.5	15.0	19.5					
NANTUCKET II	NNRN	15	40.5 N	69.5 W	03	31	M 45	5 NM	02	1000.0	0.0	5.0	5	6.5	30	< 6	23
ADM WM M CALLAGHAN	KGYE	15	43.7 N	63.9 W	06	27	50	5 NM	70	0979.0	- 1.7	1.6	5	13	27	8	14.5
TAMPA	JXNO	15	37.1 N	64.2 W	12	30	50	5 NM	27	1004.1	8.5	18.0	12	26			
VIGOROUS WMEC-627	NQSP	15	42.2 N	67.3 W	12	32	N 44	10 NM	02	0994.9	- 1.5		5	24.5	29	10	46
TFL DEMOCRACY	9VPR	15	36.8 N	60.9 W	12	31	M 48	1 NM	83	0995.0	3.0	15.0	1	18	XX		
AMERICAN RACER	KNDF	15	42.9 N	59.7 W	18	27	47	2 NM	70	0980.7	2.3	2.6	5	14.5	26	10	24.5
AMERICAN RACER	KNDF	16	42.4 N	60.4 W	00	29	45	5 NM	02	0998.9	2.3	2.6	5	14.5	27	10	24.5
BARBER TAIF	LIRD	16	37.8 N	56.7 W	00	27	45	5 NM	01	1004.0	10.0		7	24.5	27	11	19.5
ROBERT E LEE	KCRD	16	43.2 N	61.9 W	00	28	M 44	5 NM	02	0999.1	7.5	17.2	12	18	28	12	18
SEALAND INDEPENDENCE	WGJC	16	50.1 N	31.1 W	12	12	M 42	10 NM	25	1007.5	13.4	11.0	7	8	12	8	19.5
SEALAND INDEPENDENCE	WGJC	17	50.5 N	25.9 W	00	14	M 42	10 NM	02	1016.2	12.2	9.0	8	8	14	7	19.5
AMERICAN RACER	KNDF	17	40.5 N	70.1 W	06	36	50	5 NM	02	0984.1	0.5	4.5	7	19.5			
ALLTRANS ENTERPRISE	9VVD	17	34.2 N	74.6 W	06	31	M 42	5 NM	02	1001.0	9.5	20.0					
NANTUCKET II	NNRN	17	40.5 N	69.5 W	09	01	M 50	200 YD	75	0978.0	- 1.0		4	16.5	01	6	29.5
VIGOROUS WMEC-627	NQSP	17	42.5 N	67.4 W	12	35	M 61	< 50 YD	75	0970.2	.		XX	24.5	33	11	32.5
KEYSTONER	KI3R	17	33.2 N	75.2 W	12	34	45	10 NM	01	1007.8	7.8	17.2	2	6.5	34	< 6	16.5
AMERICAN ARGOSY	KFCX	17	40.2 N	58.6 W	12	17	45	5 NM	62	0981.4	13.8	13.3	7	24.5	17	7	24.5
NEW JERSEY MARU	JHYA	17	40.4 N	69.5 W	12	30	M 45	2 NM	02	0984.0	- 1.5	5.5	6	10	34	8	19.5
AMOCO VOYAGER	6ZSB	17	34.1 N	69.5 W	12	31	M 45	5 NM	25	0998.0	8.0	18.0	XX	19.5			
AMERICAN LEGEND	KFEY	17	43.4 N	60.7 W	18	12	55	2 NM	02	0965.0	7.8	2.2	6	14.5	12	10	19.5
CLARA MAERSK	OWIK	17	42.8 N	55.8 W	18	16	32	2 NM	51	0981.0	9.0	13.0	6	29.5	21	6	36
CLARA MAERSK	OWIK	18	42.6 N	57.6 W	00	23	47	1 NM	25	0976.0	6.5		4	19.5			
SUSQUEHANNA	WKDL	18	42.5 N	69.3 W	00	28	41	10 NM	02	0983.7	- 2.3	7.8	5	19.5			
AMERICAN LEGEND	KFEY	18	42.8 N	62.1 W	00	27	63	2 NM	02	0970.0	2.0	5.5	14	16.5	27	>13	23
TAMPA	JXNO	18	35.1 N	46.7 W	00	17	45	5 NM	62	1008.8	17.2	19.0	10	16.5			
ALASKAN	WTSO	18	34.9 N	72.0 W	00	25	35	5 NM	02	1001.4	15.5	20.6	6	32.5			
ALLTRANS ENTERPRISE	9VVD	18	34.9 N	69.2 W	00	26	M 46	10 NM	02	1001.5	13.5	19.5					
SEALAND PACER	KSLB	18	36.8 N	47.7 W	06	23	M 44	10 NM	01	0997.0	15.6	17.3	5	6.5	18	7	16.5
ARGONAUT	KF3V	18	36.4 N	20.5 W	12	32	25	10 NM	01	1014.0	16.7	17.2	5	5	32	7	32.5
SEALAND SALLOWAY	KHLX	18	43.6 N	41.5 W	12	16	50	2 NM	02	0999.0	12.8	13.9	8	10	16	9	19.5
ALLTRANS ENTERPRISE	9VVD	19	36.2 N	61.4 W	00	27	M 42	10 NM	02	1004.4	17.5	18.0					
CLARA MAERSK	OWIK	19	41.5 N	64.3 W	06	27	24	10 NM	02	0996.0	4.5		7	10	26	7	32.5
SEALAND PACER	KSLB	20	38.8 N	62.3 W	12	05	M 48	5 NM	02	0982.5	11.7	16.1	6	13	05	7	16.5
BUYER	KCAO	20	49.1 N	16.5 W	18	22	42	5 NM	02	0991.5	11.7	12.2	9	23	02	12	23
SEALAND ECONOMY	WNSJ	21	42.0 N	29.7 W	00	24	45	2 NM	02	0997.0	15.6	16.7	5	10	25	7	13
AMERICAN ARCHER	KFCS	21	45.0 N	56.3 W	12	05	35	5 NM	58	0985.0	1.1	2.3	7	11.5	05	9	32.5
OVERSEAS MARILYN	WFOB	21	46.6 N	14.9 W	12	21	N 45	5 NM	80	0998.0	13.5	16.8	8	29.5	26	>13	29.5
CHEVRON EDIMBURGH	A8II	21	35.8 N	67.2 W	18	30	M 48	5 NM	17	1002.6	13.8	17.0	7	19.5			

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves*		Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10's	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10's	Period sec.	Height ft.
NORTH ATLANTIC OCEAN		MAR.															
CONCORDIA SUN	LIVI	21	35.5 N	67.7 W	20	29	48	5 NM	81	1003.0	14.0	16.0	3	13	28	< 6	13
DEFIANCE	KRBS	21	38.6 N	57.2 W	21	26	50	2 NM	16	0989.0	11.2	14.5	7	29.5			
DEFIANCE	KRBS	22	38.4 N	57.5 W	00	26	50	2 NM	27	0990.5	13.4	14.5	7	29.5			
SEALAND CONSUMER	WCHF	22	49.6 N	04.7 W	00	18	46	5 NM	03	0997.9	13.3	7.2			20	8	19.5
VIGOROUS WMEC-627	NOSP	22	42.2 N	67.2 W	00	02	M 42	2 NM	68	1003.7	2.7		5	14.5	35	8	14.5
ARGONAUT	KFCV	22	40.3 N	50.4 W	06	23	54	10 NM	16	0986.5	11.1	17.8					
CONCORDIA SUN	LIVI	22	35.6 N	69.0 W	09	35	42	5 NM	81	1012.0	10.0	22.0	6	10	35	6	11.5
EL PASO ARZEW	KHKB	22	34.9 N	50.8 W	18	26	M 52	5 NM	16	0994.7	16.7	18.4	9	34.5	26	12	36
EL PASO ARZEW	KHKB	23	34.9 N	51.4 W	00	26	M 48	5 NM	01	1000.2	15.0	18.3	9	32.5	26	< 6	34.5
BUYER	KCAG	24	47.9 N	37.3 W	00	02	42	10 NM	01	0988.2	8.2	13.3	4	16.5			
FEDTRADE	ABNF	24	34.5 N	74.3 W	12	36	M 41	10 NM	01	1006.5	21.0		6	19.5	36	6	32.5
EL PASO ARZEW	KHKB	24	37.8 N	59.3 W	18	06	M 48	2 NM	16	0995.5	12.0	18.3	5	16.5	09	7	16.5
AMERICAN LEGACY	KFSJ	25	53.6 N	30.5 W	12	29	50	5 NM	27	0983.5	2.5	7.8	8	32.5	31	18	32.5
EXPORT FREEDOM	WCJS	26	39.0 N	34.5 W	12	28	50	5 NM	01	0999.0	15.6	15.6	3	5	28	< 6	16.5
BARWA	LMRH	26	47.6 N	43.6 W	18	06	44	2 NM	62	1000.0	4.0	6.8			06	10	16.5
SEALAND MARKET	KJVS	26	47.7 N	35.6 W	18	08	45	10 NM	01	0992.0	10.0	11.7	3	8	05	< 6	11.5
SEALAND LEADER	WSNH	27	44.0 N	18.2 W	12	25	M 40	5 NM	02	0993.0	14.0	12.0	5	11.5	24	9	49
AMERICAN ACE	KFCV	27	51.1 N	18.9 W	18	31	44	2 NM	03	0978.0	7.7	11.1	5	16.5	30	7	39
SEALAND SALLOWAY	KHLX	28	50.2 N	09.2 W	00	21	50	5 NM	02	0998.0	8.9	8.9	7		21	10	16.5
SCANDINAVIAN HIGHWAY	JJTK	28	40.7 N	17.3 W	18	31	M 45	5 NM	64	0995.5	14.0	15.5	6	10	31	7	13
EXPORT FREEDOM	WCJS	28	39.2 N	48.9 W	18	20	45	10 NM	64	1011.2	12.8	17.3	3	5	20	< 6	14.5
EXPORT FREEDOM	WCJS	29	39.3 N	50.5 W	00	29	48	10 NM	62	1005.8	12.2	17.3	3	6.5	29	< 6	14.5
AMERICAN ACE	KFCV	29	47.8 N	32.0 W	06	23	48	10 NM	03	0996.8	11.1	12.2	6	26	23	>13	32.5
GREAT REPUBLIC	WMRH	29	39.3 N	45.3 W	18	30	46	5 NM	02	1003.0	17.2	13.5	5	8	30	7	11.5
EXPORT COMMERCE	WDME	30	39.8 N	49.8 W	12	27	28	5 NM	07	1011.2	16.7	15.5	5	16.5	27	< 6	32.5
ANNIE JOHNSON	SLFT	30	40.5 N	26.7 W	12	19	45	2 NM	21	1018.0	16.0	15.5	10	16.5			
SEALAND RACER	KSLB	30	41.9 N	42.7 W	18	28	M 44	10 NM	02	1002.5	15.6	14.0	XX	10	27	< 6	10
AMERICAN HERITAGE	KVFN	30	36.1 N	73.8 W	18	23	50	5 NM	05	1015.2	20.5	13.3	5	6.5	21	< 6	6.5
GREAT REPUBLIC	WMRH	30	39.6 N	52.4 W	18	29	48	2 NM	07	1015.9	21.2	14.5	6	11.5	29	8	13
AMERICAN HERITAGE	KVFN	31	35.1 N	73.5 W	00	21	50	2 NM	05	1010.9	19.4	21.1	6	14.5	16	< 6	6.5
SEALAND RACER	KSLB	31	42.3 N	40.6 W	00	28	M 52	5 NM	02	1003.7	11.2	14.0					
SEALAND LEADER	WSNH	31	41.9 N	40.2 W	06	31	M 50	5 NM	60	1008.0	11.0	14.0	2	11.5	27	7	19.5
EXPORT FREEDOM	WCJS	31	40.2 N	63.0 W	12	20	45	5 NM	02	1005.8	17.2	13.9	3	5	20	6	13
GREAT REPUBLIC	WMRH	31	40.0 N	60.0 W	18	24	55	5 NM	07	1006.4	23.2	11.1	6	11.5	24	9	19.5
ENVIRONMENTAL BUOYS																	
44004		17	38.0N	070.0W	06	33	M 46			978.9	4.6	16.0	3	00			
44004		18	38.0N	070.0W	02	27	M 46			980.2	8.7	15.1	4	14			
44006		17	36.3N	075.4W	00	33	M 44			981.3	3.8	6.8					
		APR.															
AMERICAN ACE	KFCV	1	43.6 N	54.4 W	00	22	26	2 NM	01	0998.8	8.9	1.7	4	16.5	24	6	32.5
AMERICAN LEADER	KFCJ	2	48.4 N	36.2 W	06	30	60	2 NM	62	0980.7	12.2	11.1	1	11.5	30	< 6	13
BARWA	LMRH	2	50.9 N	34.2 W	12	31	58	< 50 YD	38	0997.0	4.0	10.5	12	23			
TFL DEMOCRACY	9VPR	2	48.7 N	35.3 W	12	33	M 53	2 NM	23	1006.0	6.0	12.0	13	28	33	11	32.5
BARWA	LMRH	3	51.5 N	31.2 W	00	32	42	2 NM	03	1001.5	6.0	11.0	14	23	33		
SEA LAND VOYAGER	KHPK	11	47.2 N	23.5 W	00	36	M 45	5 NM	80	1008.5	9.5	13.0	1	11.5	36	9	8
TFL EXPRESS	9VPU	11	47.6 N	24.4 W	00	34	M 48	5 NM	01	1012.6	9.0	12.3					
TAMPA	HKJA	11	17.4 N	71.3 W	12	09	45	10 NM	02	1015.2	26.7	28.8	6	24.5	09	< 6	13
TFL EXPRESS	9VPU	12	46.3 N	36.1 W	06	20	M 46	10 NM	02	1012.5	14.0	14.0					
SEALAND LEADER	WSNH	12	40.2 N	51.3 W	18	23	M 50	2 NM	02	1008.0	17.0	17.0	3	19.5	XX	7	19.5
SEA LAND VOYAGER	KHPK	12	44.1 N	42.9 W	18	20	M 50	5 NM	00	1011.8	15.0	15.0	7	10	20	< 6	10
SEA LAND VOYAGER	KHPK	13	43.8 N	45.1 W	00	19	M 50	5 NM	60	1010.2	13.3	15.0	9	13	19	9	13
VANGUARD	NIOR	13	49.6 N	34.8 W	06	16	M 47	10 NM	03	1010.0	13.4	12.3	4	8	21	6	10
TFL EXPRESS	9VPU	13	45.6 N	42.6 W	06	24	M 55	5 NM	01	0997.6	10.0	15.2	5	8	23	8	10
DRUCILLA U	ELMN	18	35.9 N	40.2 W	18	30	36	10 NM	02	1014.5	12.6	17.0	XX	8	32	11	32.5
AMERICAN EXPLORER	WTUG	18	36.8 N	38.5 W	19	33	42	5 NM	03	1011.2	11.7	17.7	5	6.5	33	7	14.5
DRUCILLA U	ELMN	19	35.7 N	43.9 W	21	24	42	5 NM	01	1007.0	17.2	16.0	1	11.5	24	9	24.5
DEL MONTE	WNYM	21	31.4 N	78.5 W	18	12	55	5 NM	25	1014.0	17.7	21.7	5	11.5	12	6	10
AMERICAN ALLIANCE	KFEM	22	40.6 N	67.5 W	12	29	45	10 NM	01	1019.3	22.0	16.2	4	16.5	29	8	19.5
TFL FREEDOM	9VRX	25	49.7 N	07.1 W	06	35	M 46	5 NM	02	1005.5	8.0	10.5	6	14.5			
AMERICAN RANGER	KNRW	26	41.1 N	50.1 W	00	17	45	2 NM	60	1008.1	17.3	14.4	5	13	18	7	14.5
SEALAND MARKET	KJVS	27	44.3 N	43.9 W	18	17	43	2 NM	02	1010.0	17.2	13.4	6	8	19	< 6	11.5
EXPORT PATRIOT	WCJY	29	40.0 N	15.2 W	06	02	45	10 NM	60	1018.5	13.3	15.0	4	8	02	6	16.5
GREAT LAKES VESSELS																	
GEORGE M HUMPHREY	9816	14	47.4 N	86.6 W	12	32	M 43	10 NM	02		- 4.0	5.0	8	8			
JOHN DYKSTRA	9852	18	47.5 N	88.1 W	06	34	M 41	10 NM	02		- 4.0	1.0	8	8			
JOSEPH H THOMPSON	9899	15	45.5 N	83.5 W	12	30	M 42	10 NM	03		-	1.0	5	8			

\+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kn or waves ≥ 25 ft from May through August (≥ 41 kn or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest windspeed was selected.

Selected Gale and Wave Observations, North Pacific

March and April 1981

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10s	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb	Temperature °C Air	Temperature °C Sea	Sea Waves* Period sec.	Sea Waves* Height ft.	Swell Waves Dir. 10s	Swell Waves Period sec.	Swell Waves Height ft.
NORTH PACIFIC OCEAN		MAR.															
EASTERN DIAMOND	MODT	1	53.6 N	175.9 E	00	27	M 50	.5 NM	44	0968.0	- 0.5	2.0	7	14.5	27	7	14.5
KOFUKU MARU	JKLB	1	53.3 N	175.1 E	00	29	M 55	200 YD	84	0971.0	- 1.1	3.0	9	24.5	29	9	26
JAPAN APOLLO	JKZL	1	54.4 N	173.1 W	18	22	M 43	5 NM	02	0975.0	2.8		8	14.5			
NOPAL BRANCO	LAHW	1	44.7 N	164.5 W	18	26	M 33	10 NM	01	1010.0	7.4	6.6	7	10	26	11	32.5
JAPAN APOLLO	JKZL	2	54.4 N	175.2 W	00	22	M 48	2 NM	25	0978.5	2.5		7	13	24	11	29.5
SANKOSTEEL	5LSN	2	54.3 N	168.4 W	06	23	M 41	5 NM	02	0992.5	2.0	5.0	5	26	27	8	28
VAN TRIUMPH	6ZJP	2	45.6 N	172.6 W	12	26	M 44	10 NM	00	1006.0	2.5	7.0					
NOPAL BRANCO	LAHW	3	44.6 N	177.2 W	06	27	M 45	5 NM	70	1003.2	2.0	5.8	5	10	XX		26
GOLDEN GATE BRIDGE	JPZD	3	36.7 N	179.0 W	12	20	M 44	5 NM	03	1004.0	15.0	13.0					
VAN TRIUMPH	6ZJP	4	48.5 N	160.0 W	00	14	M 45	2 NM	51	1002.0	4.0	5.0					
OJI GLORIA	5LTW	4	49.1 N	163.6 W	06	26	M 72	.25 NM	58	0976.0	3.0	5.0	25	13	17	11	23
SUNNY PIONEER	H3SY	4	36.2 N	144.6 E	06	20	M 43	5 NM	01	0998.6	16.0	16.0	6	16.5	20	6	16.5
DAFFODIL	H3AG	4	42.8 N	170.0 E	06	30	M 50	200 YD	07	1004.0	1.5	10.5	7	8	30	< 6	13
ATLANTIC PIONEER	H3WN	4	52.3 N	169.3 W	12	35	M 41	< 50 YD	26	0983.5	1.0						
IKAN KERISI	9VKB	4	54.5 N	165.5 W	18	25	M 60	.25 NM	74	0998.0	5.0		6	13	25	6	14.5
YOUNG SCOPE	6ZLH	4	50.2 N	155.9 W	18	25	M 48	10 NM	08	1001.0	3.5	6.0	5	10	25	11	24.5
OLGA TOPIC	A8EE	4	34.1 N	126.8 W	18	35	49	5 NM	02	1009.6	13.0	16.0	6	11.5	00		0
MADANG	ELIJ	4	54.0 N	155.5 W	23	25	65	1 NM	21	0997.0	3.0	- 0.1		24.5	25	12	18
PACBARON	A8YI	5	53.5 N	153.7 W	00	23	M 49	5 NM	60	0984.5	3.0	5.0	XX	14.5	23	< 6	32.5
OLGA TOPIC	A8EE	5	33.1 N	127.8 W	00	35	49	10 NM	02	1020.0	15.5	15.0	6	11.5	00		0
OJI GLORIA	5LTW	5	49.9 N	157.9 W	00	23	M 42	2 NM	04	1004.0	6.0	7.0	10	14.5	25	12	19.5
CHUEN ON	H3GX	5	53.9 N	149.9 W	00	18	M 45	5 NM	02	0993.0	5.0	4.0	5	11.5	18	8	26
PACIFIC VENTURE	H6VS	5	39.5 N	152.3 E	00	30	M 44	10 NM	02	0998.0	9.0	8.0	8	23	30	10	29.5
SEALAND MARINER	KGJF	5	38.2 N	154.3 E	03	29	M 43	10 NM	02	1000.0	14.0	11.0	5	8	28	11	11.5
MILLER FREEMAN	WTDM	5	55.7 N	154.4 W	06	20	M 50	1 NM	18	0977.0	3.8	5.7		8	20		29.5
WASHINGTON WOOD	JEOV	5	53.6 N	150.4 W	12	23	M 50	10 NM	03	0998.6	3.0	3.2	5	14.5	23	< 6	16.5
NOPAL BRANCO	LAHW	5	41.4 N	163.5 E	12	25	M 63	5 NM	00	0986.8	5.9		11	41	XX		
SEALAND LIBERATOR	KGJF	5	34.8 N	143.8 E	12	33	M 52	10 NM	15	1007.0	12.5	12.0	15	24.5			
MANUKAI	KNLO	5	31.7 N	123.6 W	18	31	55	5 NM	15	1010.8	11.1	15.0	6	16.5	32	10	16.5
YOUNG SEAGULL	6ZDN	5	41.1 N	166.3 E	18	27	M 50	2 NM	02	0997.6	8.5	11.0	12	26	27	13	28
OCTA	A8QG	5	40.4 N	167.4 E	18	26	M 51	2 NM	03	0999.0	7.0	10.0	12	23			
KEIYO	JKHQ	5	46.9 N	162.3 W	21	27	M 48	5 NM	22	1001.0	4.0	7.0	8	23	28	8	24.5
KEIYO	JKHQ	6	47.0 N	161.5 W	00	29	M 43	2 NM	03	1003.5	7.0	6.5	8	16.5	28	8	18
CHUEN ON	H3SX	6	53.6 N	154.5 W	00	18	M 45	2 NM	03	0997.5	4.0	7.0	7	16.5	27	8	23
EASTERN FRIENDSHIP	H8LR	6	41.0 N	178.1 W	00	22	M 45	1 NM	07	1005.0	9.0	10.0	12	8	22	12	8
NOPAL BRANCO	LAHW	6	40.9 N	162.5 E	00	29	M 25	> 25 NM	03	1009.1	5.7	6.9	6	10	XX		41
OCTA	A8QG	6	40.5 N	168.6 E	00	29	M 45	2 NM	02	1005.2	6.1	10.0	13	26			
YOUNG SEAGULL	6ZDN	6	41.4 N	167.7 E	00	27	M 40	2 NM	03	1002.5	10.0	11.0	12	26	27	13	32.5
TRIUMPH	3EZZ	6	46.9 N	175.5 W	06	14	M 50	1 NM	74	0986.0	- 1.0	2.0	10	16.5	14	9	16.5
SINALOA	OXNS	6	45.8 N	173.2 W	06	15	M 50	1 NM	69	0993.5	3.8	5.5	6	10	XX		14.5
COLUMBUS AMERICA	DITU	6	33.5 N	170.6 W	09	11	52	1 NM	02	1014.1	21.0	21.0	11	13	XX		
WESTERN HIGHWAY	3FTF	6	40.6 N	141.6 W	12	29	M 44	2 NM	80	1009.2	8.0	8.5	8	19.5			
SEALAND INNOVATOR	WGKF	6	46.1 N	153.9 E	12	29	M 42	10 NM	70	1003.5	- 0.5	1.0	10	24.5	XX		
YOUNG SCOPE	6ZLH	6	49.2 N	144.0 W	18	02	M 42	5 NM	02	0996.0	4.0	8.0	6	13	03	8	26
VAN HAWK	D5ZU	6	43.7 N	141.5 W	18	25	M 46	5 NM	02	0997.0	7.5	6.0					
VERRAZANO BRIDGE	JBXJ	6	42.5 N	174.4 W	18	17	M 46	2 NM	03	0994.5	6.5		2	10	27	8	16.5
EASTERN PACIFIC	JLVS	7	52.0 N	160.9 W	00	11	M 47	5 NM	26	0988.5	2.0	2.0	7	19.5	XX		
NEPTUNE AMBER	S6CY	7	53.6 N	138.7 W	00	05	M 42	5 NM	02	0996.5	4.5	6.0	5	6.5	06	8	10
VAN HAWK	D5ZU	7	43.8 N	139.7 W	00	18	M 48	5 NM	83	0998.0	7.5	6.0					
PHILADELPHIA	WJ30	7	54.8 N	137.9 W	00	07	55	10 NM	02	1001.0	6.7	8.9	4	10	07	< 6	19.5
WESEN EXPRESS	DLOE	7	34.0 N	140.3 W	06	05	44	2 NM	81	0994.5	5.5	9.5					
ORIENTAL EXPORTER	VRCH	7	41.3 N	155.4 W	06	20	M 47	5 NM	53	0999.0	9.5	11.0	7	19.5	18	8	10
SINALOA	OXNS	7	44.1 N	164.8 W	06	23	M 45	10 NM	02	0982.2	7.9	8.0	7	19.5			
HOEGH MIRANDA	LIQZ	7	46.0 N	155.4 W	06	24	M 45	2 NM	02	0990.0	6.7	6.1					
VERRAZANO BRIDGE	JBXJ	7	42.5 N	168.8 W	06	28	M 50	2 NM	80	0991.0	6.5	8.0	3	13	28	8	16.5
QUEENS WAY BRIDGE	JHJE	7	39.6 N	157.7 W	06	19	M 41	2 NM	63	1000.0	10.0		4	10			
PRESIDENT KENNEDY	KCAK	7	46.5 N	154.3 E	06	28	48	5 NM	72	1001.3	- 1.7	0.6	3	13	28	< 6	19.5
EASTERN FRIENDSHIP	H8LR	7	40.9 N	164.5 E	18	26	M 42	.25 NM	07	0997.5	6.0		9	5	28	10	21
SEALAND DEVELOPER	KHRH	7	35.8 N	172.3 W	12	30	M 42	10 NM	02	1016.0	11.0	13.0	3	13	30	9	21
ALVA MAERSK	OZSD	7	37.3 N	125.3 W	12	32	54	10 NM	01	1017.0	13.1						
NOPAL BRANCO	LAHW	7	36.7 N	147.9 E	18	27	M 42	5 NM	83	1011.3	13.6	16.2					
SEALAND INNOVATOR	WGKF	7	39.0 N	144.5 E	18	26	M 45	10 NM	02	1007.2	5.0	1.0	6	8			
NEWARK	WND8	8	52.8 N	133.9 W	00	16	M 50	10 NM	03	0994.9	6.7	8.3	6	16.5	16	8	23
SEATRAIN ORISKANY	D5DM	8	38.3 N	149.0 E	00	28	M 50	2 NM	02	1011.0	7.0	10.0	5	11.5	XX		10
NOPAL BRANCO	LAHW	8	36.2 N	146.0 E	00	29	M 47	> 25 NM	00	1018.2	9.1	15.7	6	16.5	XX		
EASTERN FRIENDSHIP	H8LR	8	40.5 N	163.2 W	00	31	M 42	5 NM	03	1003.5	6.0		8	13	31	6	13
VERRAZANO BRIDGE	JBXJ	8	42.6 N	160.0 W	00	29	M 46	.5 NM	23	0993.0	8.5	7.5	2	13	28	9	24.5
SEALAND DEFENDER	KGJB	8	38.7 N	147.0 E	00	27	M 45	10 NM	02	1013.5	9.5	12.0	6	10	27	6	13
HOEGH MIRANDA	LIQZ	8	44.9 N	158.9 W	06	29	M 45	5 NM	84	0983.0	4.5				28	13	39
PRESIDENT GRANT	WEZD	8	44.0 N	150.1 E	12	35	M 45	10 NM	01	1011.2	- 3.9	- 1.1			35		
BLUE OCEAN	JKDH	8	40.6 N	158.0 E	12	26	M 49	2 NM	29	1003.0	5.5	9.0	6	14.5	26	6	14.5
MOBILE MERIDIAN	KGSM	8	55.1 N	137.1 W	18	13	M 63	2 NM	63	1001.7	7.7	6.6	4	10	14	7	19.5
POLAR STAR WAGB-10	NBTM	8	44.9 N	133.4 W	18	18	48	.25 NM	63	1009.0	10.3	10.4	8	14.5			
SANSINENA II	WSIN	8	46.6 N	133.5 W	18	16	45	5 NM	63	1007.3	8.9	6.7	8	13	20	12	19.5
ARCO FAIRBANKS	WGWB	8	55.3 N	139.1 W	18	12	M 41	1 NM	65	0996.9	6.1	5.6	6	8	12	6	10
SEALAND MARINER	KGJF	8	40.0 N	163.6 W	21	30	M 50	10 NM	01	1000.5	9.2	10.0	5	8	27	8	19.5
SEALAND MARINER	KGJF	9	40.0 N	162.0 W	00	29	M 41	10 NM	02	1002.0	11.5	10.0	8	6.5	28	>13	16.5
IRIS ISLAND	JPKS	9	51.2 N	132.0 W	00	13	M 40	< 50 YD	04	1001.2	9.0	8.0	10	32.5	26	9	32.5
EASTERN FRIENDSHIP	H8LR	9	39.7 N	156.3 W	00	23	M 49	200 YD	07	0999.5	11.0	10.0	8	13	23	13	13
POLAR STAR WAGB-10	NBTM	9	45.5 N	132.0 W	00	17	43	5 NM	02	1010.8	10.3	10.2	4	14.5			
SANSINENA II	WSIN	9	46.0 N	132.6 W	00	17	45	5 NM	61	1009.5	10.3	7.3	6	13	17	8	23
DAFFODIL	H3AG	9	46.5 N	150.0 W	06	16	M 50	5 NM	07	0985.5	7.0	8.5	6	8	18	7	11.5
MOBILE MERIDIAN	KGSM	9	54.5 N	138.3 W	06	13	M 45	2 NM	63	1004.1	8.3	6.6	6	19.5	15	10	32.5
SINALOA	OXNS	9	46.3 N	148.5 W	12	15	M 50	5 NM	18	0993.0	8.0	7.6	6	13			
PRESIDENT MC KINLEY	WVPZ	9	38.7 N	149.4 W	12	30	50	10 NM	00	1017.0	12.2	11.1		5	30	9	16.5
TRIUMPH	3EZZ	9	48.2 N	148.7 W	18	22	M 55	1 NM	23	0980.0	2.0	5.0	10	16.5	21	9	16.5
GOLDEN PRINCE	6ZCU	9	34.5 N	154.7 E	18	18	M 48	1 NM	25	1004.5	14.0	17.0	9	16.5	18	9	16.5
CRYSTAL STAR	D5TS	9	36.6 N	152.1 E	18	23	M 45	1 NM	64	0991.0	17.0	15.0	8	10	21	8	10
PERENNIAL ACE	HOMQ	9	39.6 N	173.9 W	18	35	M 41	1 NM	07	1000.5	7.5	10.5		8	35	8	11.5
MAYA PIONEER	JLAX	9	40.2 N	148.2 E	18	07	M 50	.5 NM	26	1002.9	1.0	0.7		14.5	07	7	16.5
EASTERN PACIFIC	JLVS	10	52.2 N	148.2 W	00	15	M 45	10 NM	02	0980.0	4.0	3.0	6	23	XX		
SEPTA	A8JQ	10	33.9 N	157.0 E	00	21	M 50	2 NM	02	1007.0	16.0	13.0	8	16.5	21	8	19.5
GOLDEN PRINCE	6ZCU	10	34.2 N	155.3 E	00	21	M 45	.5 NM	10	1002.6	16.5	16.0	8	16.5	21	9	19.5
FRISKY	3FAB	10	32.0 N	154.5 W	00	27	54	5 NM	21	1012.0	18.9	- 1.2	5	6.5	27	< 6	6.5

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb	Temperature °C		Sea Waves*			Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.
NORTH PACIFIC OCEAN		MAR.																
TRIUMPH	3EZZ	10	48.9 N	147.2 W	00	24	N 58	5 NM	03	0992.0	4.0	5.0	10	16.5	29	9	16.5
PACBARONESS	SLFX	10	34.0 N	157.3 E	00	20	N 52	.5 NM	00	1007.0	17.0	17.0	6	14.5	20	7	19.5
ORIENTAL EXECUTIVE	DSAN	10	34.4 N	138.4 E	06	28	N 44	10 NM	01	1013.0	12.0						
AMERICA MARU	JNRV	10	33.9 N	158.4 W	06	22	N 42	5 NM	03	1006.5	15.0	16.0	4	10	26	7	14.5
SEALAND DEVELOPER	KHRH	10	35.1 N	162.6 E	06	20	N 44	5 NM	63	1005.0	16.2	14.0	4	8	21	10	19.5
EASTERN FRIENDSHIP	H8LR	10	39.5 N	144.7 W	12	20	N 41	2 NM	03	1013.0	12.0		12	8	20	10	11.5
MILLER FREEMAN	WTDM	10	56.3 N	155.0 W	12	05	N 48	10 NM	02	0981.5	3.4	3.9		3	10	6	11.5
NEPTUNE DIAMOND	9VYT	10	44.6 N	165.9 E	12	10	N 42	.25 NM	86	0980.0	2.0						
SUNNY PIONEER	H3SY	10	47.3 N	168.1 W	18	31	N 46	5 NM	03	0994.4	2.5	2.0	8	14.5	31	8	14.5
SEALAND MARINER	KGJF	10	39.3 N	142.6 W	18	17	N 42	10 NM	60	1015.0	13.2	12.0	5	3	18	6	11.5
EASTERN WORLD	ELVA	10	47.1 N	173.6 E	23	11	N 58	.5 NM	84	0997.2	3.0	3.0	5	16.5	13	7	49
SEALAND MARINER	KGJF	11	38.9 N	140.0 W	00	17	N 41	10 NM	02	1017.3	14.8	12.0	5	5	18	8	10
EXXON SAN FRANCISCO	KAAC	11	51.5 N	135.4 W	00	15	N 42	10 NM	02	1021.6	9.8	5.6	5	23	27	6	10
EASTERN FRIENDSHIP	H8LR	11	40.5 N	141.9 W	00	18	N 42	2 NM	03	1012.0	12.0		12	8	18	10	11.5
KEYSTONE CANYON	KSFK	11	55.3 N	140.1 W	01	11	45	1 NM	07	1007.9	5.6	3.9	7	26	18	10	10
NEPTUNE DIAMOND	9VYT	11	45.9 N	174.1 E	06	27	N 48	2 NM	02	0981.0	3.5	5.9	8	8	24	9	23
TRIUMPH	3EZZ	11	50.1 N	140.6 W	06	15	N 42	1 NM	18	1000.0	7.0	5.0	10	16.5	15	9	16.5
ENNA G	C2DG	11	37.5 N	123.2 W	08	32	30	5 NM	02	1019.1	12.2	14.0	6	10	32	9	32.5
CRYSTAL STAR	D5TG	11	38.1 N	161.1 E	12	27	N 52	10 NM	01	1014.8	5.0	10.5	12	13	27	12	13
ARCO FAIRBANKS	WGWB	11	58.5 N	143.4 W	12	14	N 50	5 NM	07	0999.0	5.0	3.8	4	10	13	6	10
PHILADELPHIA	WJSO	11	56.3 N	143.6 W	12	14	55	2 NM	65	0994.2	7.2	6.7	4	19.5	14	< 6	28
SOHIO INTREPID	KACK	11	56.3 N	141.6 W	12	14	42	10 NM	50	1000.3	6.7	7.3	6	24.5			
SEALAND DEFENDER	KGJB	11	49.8 N	174.4 W	12	11	N 45	.5 NM	73	0981.0	1.0	5.0	5	10	12	7	11.5
CHUEN ON	H3SX	11	46.6 N	153.0 E	18	32	N 45	2 NM	65	1014.0	- 1.0	2.0					
EASTERN WORLD	ELVA	11	48.3 N	179.4 W	23	33	N 24	10 NM	05	0987.2	5.0	3.8	2	6.5	22	>13	49
NEPTUNE DIAMOND	9VYT	12	42.8 N	177.0 W	06	28	N 45	5 NM	01	0997.1	4.5		12	18	27	9	24.5
ATLANTIC PIONEER	H3WN	12	41.5 N	140.6 E	06	25	N 53	5 NM	05	1018.5	8.0		6	8	28	< 6	13
HOEGH MIRANDA	LIGZ	12	43.3 N	173.7 W	06	26	N 50	5 NM	90	0991.0	5.1	7.9			26	>13	49
CHUEN ON	H3SX	12	44.0 N	147.8 E	12	21	N 45	2 NM	65	1014.0	2.5	1.0					
SUNNY PIONEER	H3SY	12	48.4 N	153.4 W	12	16	N 58	.25 NM	65	0985.6	7.8	4.8	7	29.5	14	7	29.5
CRESSIDA	3FTB	12	44.2 N	169.4 W	12	23	N 53	1 NM	02	0989.0	4.8	10.5	9	23	23	9	26
MORGENTHAU WHEC 722	NDWA	12	54.0 N	162.6 W	15	07	N 51	5 NM	63	0962.5	2.2	4.4	5	8			
IRIS ISLAND	JPKG	12	54.1 N	161.0 W	18	09	N 43	.5 NM	54	0991.5	5.5	4.5	10	24.5	09	10	16.5
SKAUGRAN	LNUK	13	54.2 N	150.7 W	00	14	48	1 NM	07	0984.5	4.0	5.4	10	26	XX		
PERENNIAL ACE	HOMQ	13	39.9 N	147.5 W	00	22	N 48	1 NM	61	1014.0	11.5	10.5	6	8	22	9	11.5
SINCERE NO 3	ELRT	13	43.4 N	155.7 W	00	34	N 42	5 NM	04	1009.0	6.0	10.0	8	14.5	34	9	19.5
HOEGH MIRANDA	LIOZ	13	40.9 N	176.5 W	12	31	N 46	5 NM	02	1015.0	5.0						
ARCO JUNEAU	KSRG	13	56.4 N	140.9 W	12	13	N 42	10 NM	00	0992.2	5.0	3.1	6	11.5			
HIEI MARU	JDOC	13	43.4 N	176.4 W	12	29	N 45	2 NM	03	1010.0	2.5	7.0	5	11.5	28	12	16.5
CRESSIDA	3FTB	13	44.2 N	172.5 W	18	27	N 44	5 NM	05	1005.0	7.0	11.3	9	19.5	27	9	21
ALEUTIAN DEVELOPER	WIPL	13	59.7 N	148.4 W	18	06	36	2 NM	63	0985.8	3.9	5.0	7	14.5	12	11	24.5
EASTERN WORLD	ELVA	13	50.7 N	163.2 W	23	30	N 35	10 NM	01	0997.0	7.0	0.3	4	10	27	8	32.5
CRYSTAL STAR	D5TG	14	42.4 N	175.4 W	18	26	N 60	1 NM	02	0991.5	5.0	7.0	10	13	26	10	26
CRESSIDA	3FTB	14	43.6 N	175.7 W	18	29	N 54	2 NM	05	0990.0	3.0	12.4	9	19.5	29	9	21
HOMSING BREEZE	3EOU	14	44.0 N	172.4 W	18	26	N 45	5 NM	03	0980.0	3.0	6.0	10	16.5	26	9	16.5
WASHINGTON WOOD	JEOV	14	40.2 N	138.1 E	18	18	N 45	2 NM	03	1000.1	6.0	8.5	5	10	18	< 6	10
SEALAND PATRIOT	KHRF	14	40.0 N	176.1 W	18	27	N 45	10 NM	90	1002.6	6.0	8.0	6	11.5	27	10	16.5
HOEGH MIRANDA	LIOZ	14	38.7 N	179.7 W	18	28	N 50	5 NM	90	1008.0	6.0				28	11	32.5
HOEGH MIRANDA	LIOZ	15	38.4 N	179.9 W	00	29	N 30	10 NM	81	1014.0	9.0	11.1	10	36			
ARCO JUNEAU	KSRG	15	50.4 N	131.4 W	00	13	N 47	5 NM	63	0997.0	10.0	4.4	8	16.5			
SEALAND LIBERATOR	KHRP	15	32.9 N	175.5 W	00	28	N 42	5 NM	07	1018.0	15.0	14.0	14	19.5			
HOMSING BREEZE	3EOU	15	44.2 N	170.7 W	00	33	N 48	.5 NM	07	0983.2	3.0	6.0	11	28	32	11	24.5
PACNOBLE	D5YM	15	43.5 N	153.4 E	00	14	N 43	200 YD	39	1008.0	0.0	0.0	3	10	14	8	19.5
STREAM BOLLARD	ELYM	15	31.0 N	134.1 E	00	27	N 45	10 NM	03	1008.4	19.0	20.0	6	10	27	7	13
CRESSIDA	3FTB	15	43.8 N	177.2 W	06	29	N 52	2 NM	36	1006.0	3.0	13.2	9	23	29	9	24.5
SAMOA	OXTZ	15	35.1 N	140.9 E	06	24	N 50	5 NM	00	0994.4	17.0	16.5	6	13			
HIEI MARU	JDOC	15	40.9 N	156.1 W	06	19	N 42	1 NM	63	0995.5	8.0	8.5	5	8	22	12	16.5
ITALY MARU	JISX	15	33.0 N	164.5 W	06	24	N 43	10 NM	03	1010.5	14.5	16.5	2	6.5	26	7	8
SKAUGRAN	LNUK	15	53.9 N	171.6 W	12	33	42	1 NM	56	0984.0	- 1.5		8	19.5			
JUTHLANDIA	ELRV	15	46.6 N	152.2 E	12	12	41	.5 NM	68	0970.0	- 3.0	- 3.2	5	13	XX		
CRYSTAL STAR	D5TG	15	42.8 N	170.4 W	12	30	N 56	5 NM	02	0998.5	2.5	6.0	12	13	30	12	19.5
ORIENTAL TAIO	A8CV	15	44.9 N	161.1 E	18	18	N 45	.25 NM	62	0994.0	5.0	8.0	7	13	18	< 6	8
ALEUTIAN DEVELOPER	WIPL	15	56.6 N	155.0 W	18	11	42	2 NM	10	0981.5	4.4	2.8	6	13	20	10	16.5
PRESIDENT FILLMORE	KRDH	15	46.6 N	155.9 E	18	17	45	2 NM	65	0973.2	2.2	4.4			17		
PRESIDENT TYLER	WEZM	15	34.9 N	145.3 W	18	19	N 28	10 NM	02	1017.3	12.2	13.3	4	8	28	13	32.5
PACIFIC ARROW	JGFN	15	34.2 N	158.8 W	18	29	N 41	10 NM	27	1006.0	11.0		4	6.5	30	12	19.5
EASTERN TREASURE	6ZSP	16	41.6 N	153.8 E	00	25	N 45	5 NM	01	0986.0	7.0	8.0	8	16.5	25	13	24.5
ORIENTAL TAIO	A8CV	16	45.3 N	161.5 E	00	18	N 42	1 NM	82	0977.0	6.0	8.0	7	11.5	18	< 6	10
DIAMOND PHOENIX	D5M5	16	44.0 N	164.3 E	00	19	41	1 NM	18	1009.0	6.0	6.0	6	16.5	20	9	26
KOREAN FIR	A8WW	16	45.3 N	158.3 E	00	22	N 29	5 NM	03	0979.0	5.0	2.0	9	16.5	19	12	32.5
JUTHLANDIA	ELRV	16	45.2 N	150.4 E	06	27	60	5 NM	39	0976.5	- 2.5	- 3.5			XX		
PRESIDENT FILLMORE	KRDH	16	45.6 N	154.6 E	06	27	65	.5 NM	02	0963.5	2.2	7.2	5	18	27	10	36
GOLDEN GATE BRIDGE	JPZD	16	34.4 N	156.5 W	18	31	N 41	10 NM	62	1006.0	7.5	13.5	3	6.5	30	10	26
VAN TRIUMPH	6ZJP	16	54.0 N	148.5 W	18	14	N 47	2 NM	52	0995.0	6.0	6.0					
EASTERN TREASURE	6ZSP	17	43.1 N	159.9 E	00	25	N 45	2 NM	26	0993.0	1.0	2.0	9	19.5	25	>13	26
NEWARK	WNDO	17	58.3 N	149.0 W	00	11	N 45	5 NM	03	1011.2	5.0	5.0	5	13	09	6	14.5
PACNOBLE	D5YM	17	47.0 N	166.5 E	00	25	N 41	2 NM	02	0976.0	3.0	0.0	3	19.5	25	8	28
KOREAN FIR	A8WW	17	46.8 N	166.4 E	00	23	N 38	10 NM	01	0979.0	2.0	4.0	9	16.5	23	12	32.5
PRESIDENT FILLMORE	KRDH	17	44.8 N	153.4 E	00	29	45	5 NM	02	0990.0	.	6.1	8	11.5	29	12	23
PRESIDENT TYLER	WEZM	17	33.6 N	155.3 W	00	34	N 46	10 NM	62	1010.3	10.6	12.2	8	21	30	12	36
LEO	SLHT	17	45.0 N	164.6 E	01	25	N 48	5 NM	04	0982.0	2.0	6.0	9	31	25	9	28
PRESIDENT HOOVER	WTST	17	45.9 N	177.6 W	06	22	N 42	2 NM	02	0994.5	5.5	5.0	4	16.5	22	9	24.5
PHILADELPHIA	WJSO	17	55.9 N	140.8 W	06	12	17	5 NM	02	1022.5	6.7	8.9	5	8	18	< 6	32.5
HIEI MARU	JDOC	17	37.9 N	134.0 W	12	13	N 42	.5 NM	63	1005.0	14.0	14.5	5	10	14	11	18
PRESIDENT JACKSON	KADB	17	45.2 N	134.4 W	18	14	35	2 NM	07	1009.1	10.0	8.3	4	10	14	9	32.5
MOBIL ARCTIC	KSPY	17	48.6 N	130.4 W	18	13	N 43	10 NM	02	1022.1	9.5	7.8	5	10	18	7	6.5
MORGENTHAU WHEC 722	NDWA	17	55.7 N	147.2 W	21	10	N 45	5 NM	02	1010.0	7.2	3.9	5	10			
MOBIL ARCTIC	KSPY	18	47.0 N	131.6 W	00	13	N 45	10 NM	02	1005.8	9.5	7.8	4	6.5	18	6	6.5
PRESIDENT JACKSON	KADB	18	45.0 N	134.5 W	00	13	40	2 NM	07	1006.0	11.1	7.8	5	11.5	14	9	32.5
PHILADELPHIA	WJSO	18	58.5 N	149.1 W	00	09	45	5 NM	02	1015.9	7.2	6.1	5	13	09	6	26
OJI GLORIA	SLTW	18	52.8 N	142.3 W	00	12	N 47	2 NM	04	1010.0	6.0	7.5	8	16.5	12	12	19.5
PACPRINCE	ELTG	18	51.2 N	143.6 W	00	11	44	1 NM	49	0999.8	8.2	7.0	9	14.5	11	9	14.5
KENAI	WSNB	18	48.6 N	133.2 W	06	11	40	10 NM	02	1013.5	7.8	5.0	5	13	18	10	32.5
GOLDEN GATE BRIDGE	JPZD	18	31.4 N	171.1 W	18	18	N 48	1 NM	65	1008.0	10.0	15.0	3	13	18	8	13

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb	Temperature °C Air	Temperature °C Sea	Sea Waves? Period sec.	Sea Waves? Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.	Swell Waves Height ft.
NORTH PACIFIC OCEAN		MAR.																
PRESIDENT TYLER	WEZM	19	32.7 N	171.5 W	00	27	M	42	5 NM	03	1007.0	16.7	12.8	8	14.5	23	6	16.5
NEWARK	WNDQ	19	59.0 N	151.3 W	00	14	M	45	1 NM	20	1006.8	5.6	3.3	6	13	14	9	23
EXXON NORTH SLOPE	KHLQ	19	59.7 N	145.2 W	18	30	M	44	10 NM	20	1017.6	6.0	4.4	2	5	13	8	13
ALEUTIAN DEVELOPER	WIPL	20	54.1 N	160.6 W	00	10	M	48	5 NM	02	0995.0	5.0	3.3	6	14.5	10	9	24.5
OJI GLORIA	SLTW	20	54.0 N	159.7 W	00	10	M	46	5 NM	04	1001.0	4.5	5.0	7	13	11	9	14.5
PACNOBLE	DSYM	20	49.2 N	168.0 W	00	33	M	54	200 YD	54	0973.0	0.0	0.0	6	16.5	33	7	24.5
KOREAN FIR	ABWW	20	47.1 N	168.1 W	00	27	M	47	.25 NM	52	0983.0	6.0	4.0	5	6.5	24	< 6	8
QUEENS WAY BRIDGE	JHJE	22	34.6 N	172.8 W	00	23	M	41	5 NM	21	1008.5	15.5	13.6	3	6.5	26	7	13
CALIFORNIA RAINBOW	JHJL	22	37.7 N	173.7 W	06	30	M	41	2 NM	01	0999.0	9.5	13.0	5	8	29	11	18
PACIFIC VENTURE	HOVS	22	49.4 N	161.2 E	06	30	M	52	5 NM	88	1003.0	- 2.0	0.0	9	18	30	11	29.5
PRESIDENT KENNEDY	KCAK	22	38.5 N	158.0 E	18	09		45	5 NM	62	0996.0	12.2	10.0	4	8	05	7	10
SEALAND EXPLORER	WGJF	22	40.1 N	167.4 W	18	27	M	62	5 NM	81	0989.5	6.0	8.0	8	32.5	27	13	52.5
SKOUBORD	LION	22	39.8 N	164.4 W	18	27		43	2 NM	81	1001.0	8.5		5	6.5	26	10	23
PHILADELPHIA	WJSO	23	52.8 N	134.1 W	00	16		45	5 NM	02	1002.4	10.0	10.0	4	13	17	< 6	19.5
SEALAND EXPLORER	WGJF	23	39.7 N	161.6 W	05	27	M	50	5 NM	01	0994.5	7.5	9.0	8	32.5	27	12	46
SKOUBORD	LION	23	39.5 N	160.9 W	06	27		48	2 NM	81	1007.0	8.0		5	8	27	12	26
PACIFIC VENTURE	HOVS	23	43.3 N	150.1 E	18	32	M	44	200 YD	44	1004.5	1.0	0.0	8	16.5	32	8	21
EASTERN TREASURE	6ZSP	23	49.3 N	146.0 W	18	11	M	41	5 NM	51	0992.0	6.0	6.0	6	13	10	9	19.5
ORIENTAL TAIO	A8CV	24	47.4 N	138.5 W	00	16	M	42	1 NM	81	0989.0	10.0	12.0	6	16.5	16	6	16.5
PACIFIC VENTURE	HOVS	24	42.5 N	148.2 E	00	33	M	55	5 NM	85	1013.0	- 1.0	0.0	9	19.5	32	12	29.5
SKOUBORD	LION	24	39.1 N	156.0 W	00	29		42	2 NM	80	1011.0	9.6						
PRESIDENT TYLER	WEZM	24	34.4 N	146.5 E	00	01	M	50	10 NM	01	1023.5	9.4	13.3	9	31			
MOBIL ARCTIC	KSPY	24	51.5 N	136.1 W	06	13	M	47	2 NM	63	0998.4	8.3	6.7	4	13			
SEATRAIN YORKTOWN	D5NP	24	33.7 N	162.0 E	06	28	M	48	5 NM	02	1004.5	13.0	15.0	10	23	28	>13	32.5
PRESIDENT VAN BUREN	WWPI	24	33.0 N	162.1 W	06	32		13	10 NM	01	1022.0	12.2	13.3	2	3	32	9	42.5
NEPTUNE DIAMOND	9VYT	24	50.7 N	132.3 W	12	14	M	46	5 NM	50	1003.2	8.8				XX		
SEALAND MARINER	KGJF	24	34.1 N	161.3 E	12	29	M	50	5 NM	27	1005.5	9.5	16.0	5	11.5	28	13	19.5
MAYA PIONEER	JLAX	24	55.8 N	138.8 W	18	10	M	41	10 NM	52	0993.7	6.5	6.0	6	19.5	10	8	23
ALEUTIAN DEVELOPER	WIPL	24	49.1 N	126.8 W	18	10		44	5 NM	02	1012.0	10.6	8.3	6	8	12	8	11.5
PRESIDENT KENNEDY	KCAK	25	39.6 N	177.7 E	00	27		43	10 NM	62	0987.0	8.0	10.6	5	10	25	8	24.5
BOUTWELL WHEC 719	NYCQ	25	52.9 N	169.7 W	06	12		45	2 NM	10	0988.2	3.0	4.4		8			
SEALAND INNOVATOR	WGKF	25	42.5 N	179.0 E	06	26	M	55	2 NM	81	0978.2	5.5	9.0	8	29.5	24	10	32.5
ORIENTAL EXECUTIVE	D5AN	25	35.1 N	146.1 E	18	18	M	41	2 NM	63	1006.0	17.0						
PERENNIAL ACE	HOMQ	25	52.8 N	170.6 E	18	02	M	43	5 NM	07	0989.0	3.0	3.0			34	10	16.5
ORIENTAL EXECUTIVE	D5AN	26	35.1 N	148.1 E	00	19	M	44	2 NM	63	1004.0	17.0						
IKAN KERISI	9VKS	26	36.6 N	145.8 E	00	20	M	48	2 NM	61	0995.0	18.0	16.0	7	23	22	8	26
VIOLET	H8DF	26	53.4 N	174.9 E	00	03	M	44	2 NM	02	0982.0	3.0	5.0	5	10	01	10	11.5
PRESIDENT VAN BUREN	WWPI	26	33.0 N	179.3 E	06	29		28	10 NM	02	1013.5	9.4	13.9	4	6.5	30	7	32.5
SEALAND DEVELOPER	KHRH	26	40.6 N	158.0 E	12	14	M	43	5 NM	51	0998.0	7.0	6.0	3	8	15	8	10
PERENNIAL ACE	HOMQ	27	48.0 N	156.8 W	09	08	M	42	1 NM	73	0990.0	0.0	2.0	5	6.5	07	10	13
DIANA	D5JV	27	40.6 N	159.9 E	23	25	M	46	5 NM	23	0992.5	9.0	8.0	11	14.5	25	11	14.5
DIANA	D5JV	28	40.7 N	161.1 E	05	26	M	45	5 NM	40	0993.5	6.0	8.0	16	19.5	26	6	19.5
VIENNA WOODS	5LOT	28	53.1 N	172.1 E	05	33	M	50	1 NM	72	0987.0	0.5	1.0	10	18	33	10	18
PRESIDENT TAFT	WLOT	29	49.2 N	162.5 E	12	31		42	5 NM	22	1000.4	0.2	1.7	4	10	XX	6	16.5
MAINE ORE	6ZPT	31	50.6 N	178.4 W	12	22		45	2 NM	07	0982.0	2.5	4.0	9	24.5			
PRESIDENT GRANT	WEZD	31	42.9 N	167.2 W	12	18	M	43	5 NM	15	1017.8	9.4	5.0	5	10			
ENVIRONMENTAL BUOYS																		
46003		04	52.0N	156.0W	22	26		M 61						8	28			
46003		08	52.0N	156.0W	02	26		M 42						6	23			
46003		12	52.0N	156.0W	13	14		M 43						4	11			
		APR.																
MALAYAN REEFER	DUHF	1	30.7 N	155.6 E	10	05		60	5 NM	02	1019.0	15.1		7	5	05	7	5
PRESIDENT TAFT	WLOT	2	31.0 N	132.8 E	12	34		43	2 NM	34	1001.4	.	21.1	4	10	34	6	16.5
PRESIDENT MC KINLEY	WYFZ	2	35.2 N	141.4 E	12	14		20	10 NM	02	1005.0	11.7	16.1	3	5	20	8	32.5
ARCO JUNEAU	KSBG	2	51.6 N	134.7 W	12	29	M	50	10 NM	00	1008.5	8.3	5.0	6	13	30	10	10
PERENNIAL ACE	HOMQ	2	41.3 N	152.2 E	15	15	M	55	2 NM	63	0982.0	9.5	10.0					
CHIBA	5MSN	2	41.7 N	147.9 E	18	27	M	42	2 NM	63	0980.0	4.0						
SKAUGRAN	LHUK	2	36.8 N	144.6 E	18	32		45	5 NM	01	1004.5	9.1		10	14.5			
MALAYAN REEFER	DUHF	2	28.0 N	166.1 E	20	09		56	10 NM	01	1020.0	22.6		6	5	09	6	8
OLGA TOPIC	A8EE	3	37.9 N	157.1 E	00	17		47	1 NM	81	1009.5	12.3	13.0	7	13	00	9	0
CHIBA	5MSN	3	42.6 N	149.6 E	00	25	M	48	.5 NM	69	0972.0	2.0		7	32.5	24	7	32.5
OJI GLORIA	SLTW	3	43.2 N	151.4 E	00	13	M	46	2 NM	04	0976.5	3.0	2.5	9	19.5	18	12	19.5
SKAUGRAN	LHUK	3	36.9 N	146.2 E	00	28		50	10 NM	01	1008.4	10.8	15.0	12	23			
MALAYAN REEFER	DUHF	3	27.5 N	168.0 E	03	09		45	10 NM	01	1020.0	26.0		7	6.5	09	7	8
SOUTH EXPRESS	A8QR	3	43.3 N	153.5 E	06	14	M	50	1 NM	69	0969.0	2.0	1.0	6	42.5	22	10	19.5
SEALAND LIBERATOR	KHPP	3	46.1 N	163.6 E	06	14	M	50	2 NM	81	0996.2	6.0	2.0	10	19.5			
BLUE OCEAN	JKDH	3	43.5 N	147.7 E	06	32	M	60	.5 NM	60	0984.0	1.5	0.0	6	29.5	32	9	36
WASHINGTON WOOD	JEDV	3	47.5 N	160.5 E	06	18	M	55	5 NM	01	0985.0	3.0	0.5	5	11.5	18	< 6	11.5
ATLANTIC PIONEER	H3WN	3	41.5 N	149.9 E	12	28	M	50	1 NM	05	0995.0	4.0	3.0					
GALLEON AQUAMARINE	DZMK	3	38.2 N	168.1 E	12	28	M	42	5 NM	07	1012.5	14.0	18.0	8	11.5	16	8	11.5
PRESIDENT MC KINLEY	WYFZ	3	36.0 N	150.0 E	12	28		50	10 NM	02	1013.0	11.7	17.2	3	10	30	>13	39
PRESIDENT HOOVER	WTST	3	41.4 N	171.6 E	12	17	M	50	10 NM	02	1015.7	8.9	9.4	6	10	32	6	10
PERENNIAL ACE	HOMQ	3	44.1 N	159.3 E	15	22	M	48	2 NM	61	0978.0	5.0	4.0					
JAPAN CACBO	5MKV	3	37.4 N	154.7 E	18	26		45	10 NM	02	1010.0	10.5	18.0					
PRESIDENT MC KINLEY	WYFZ	4	35.0 N	155.0 E	00	28		22	10 NM	01	1016.0	15.6	15.5	4	6.5	28	6	32.5
GALLEON AQUAMARINE	DZMK	4	37.4 N	170.5 E	00	18	M	44	2 NM	80	1006.5	14.5	18.0	8	13	16	8	13
SEALAND LIBERATOR	KHPP	4	47.6 N	172.4 E	00	17	M	42	1 NM	61	0995.7	5.5	1.0	12	16.5	16	13	19.5
SARGODHA	GUIU	4	48.5 N	174.5 E	00	16	M	50	2 NM	51	1001.5	5.4	0.0	5	14.5			
EASTERN DIAMOND	HODT	4	48.9 N	176.5 E	05	16	M	45	.5 NM	25	1006.5	4.5	4.0	9	8	16	9	14.5
PRESIDENT HOOVER	WTST	4	40.2 N	165.5 E	06	25	M	45	5 NM	02	1005.0	10.0	10.6	7	10	25	>13	19.5
PERENNIAL ACE	HOMQ	4	46.2 N	166.2 E	12	25	M	45	2 NM	63	0988.5	4.0	3.0					
ARCO FAIRBANKS	WGWB	4	51.2 N	134.9 W	18	20	M	41	2 NM	51	0999.2	7.2	7.2	5	10	23	6	13
OVERSEAS JUNEAU	WKND	5	56.6 N	140.3 W	12	33		45	10 NM	01	1009.2	5.0	5.6					
MALAYAN REEFER	DUHF	5	26.8 N	173.7 W	20	10		45	5 NM	02	1023.0	27.6		6	11.5	09	6	8
MALAYAN REEFER	DUHF	6	26.0 N	170.6 W	08	10		45	5 NM	01	1021.0	24.0		6	11.5	09	6	8
SEALAND DEVELOPER	KHRH	6	38.2 N	123.9 W	12	34	M	45	10 NM	00	1016.2	12.0	12.0	3	8	33	7	16.5
FRISKY	3FAB	7	42.5 N	153.5 E	12	05		48	10 NM	03	1004.0	3.3		13	6.5	12	< 6	6.5
MANULANI	KNIJ	7	37.2 N	124.4 W	18	34		43	5 NM	02	1018.5	16.1	12.8	8	18	XX		
PRESIDENT TRUMAN	WLPL	10	39.9 N	172.8 E	00	30		50	10 NM	02	1020.0	7.2	11.1	7	6.5	30	12	14.5
PACNOBLE	DSYM	10	50.6 N	159.4 E	00	28	M	42	2 NM	02	1005.0	2.0	0.0	4	13	28	7	26
PRESIDENT TYLER	WEZM	10	35.6 N	143.1 E	04	20	M	50	2 NM	25	0997.2	18.3	18.9	5	21	12	13	23
PRESIDENT TRUMAN	WLPL	11	38.9 N	157.7 E	18	20		50	5 NM	20	0996.3	12.3	10.5	5	6.5	20	10	14.5
PRESIDENT TRUMAN	WLPL	12	38.8 N	156.9 E	00	27		55	5 NM	02	1003.0	8.8	6.1	7	6.5	27	>13	34.5
PRESIDENT TAFT	WLOT	12	46.7 N	175.3 E	12	16		54	2 NM	64	0999.8	6.1	3.9	5	19.5	16	6	19.5
PRESIDENT TAFT	WLOT	13	48.6 N	178.8 W	00	15		46	2 NM	52	1000.6	5.6	3.3	5	19.5	16	8	19.5
SEALAND DEVELOPER	KHRH	13	38.7 N	167.2 E	00	28	M	38	10 NM	01	1013.1	10.7	12.0	3	13	28	7	32.5
CHUEN ON	H3SK	14	37.7 N	173.5 W	12	25	M	45	2 NM	02	1006.5	13.0	13.0					

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind			Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves*			Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.					Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.
NORTH PACIFIC OCEAN		APR.																	
EASTERN WORLD	ELVA	14	47.6 N	164.3 E	22	29	N	65	.25 NM	39	0997.6	- 1.0	0.1	6	16.5	32	11	52.5
SEATRAIN ORISKANY	DSOM	15	46.6 N	173.0 E	06	27	N	55	5 NM	50	0991.0	3.0	4.0	9	29.5	XX	>13	32.5
PACIFIC VENTURE	HDVS	15	49.3 N	162.1 E	12	27	N	41	1 NM	07	0970.6	- 1.0	0.0	6	14.5	27	8	32.5
RED ARROW	SLTT	15	39.4 N	163.6 E	12	27	N	50	5 NM	52	1003.0	6.0	10.2	4	8	27	7	16.5
VAN TRIUMPH	6ZJP	15	40.4 N	168.6 E	18	29	N	55	5 NM	02	1001.0	6.0	10.5					
EASTERN TREASURE	6ZSP	15	48.9 N	161.2 E	18	25	N	52	1 NM	75	0975.0	0.0	1.0	10	32.5	27	13	36
PACIFIC VENTURE	HDVS	16	47.7 N	158.9 E	00	30	N	47	.5 NM	46	0977.0	0.0	0.0	6	14.5	30	9	29.5
EASTERN TREASURE	6ZSP	16	47.8 N	160.7 E	06	29	N	45	.5 NM	75	0985.5	1.0	1.0	10	42.5	28	>13	41
SEATRAIN ORISKANY	DSOM	16	43.9 N	168.2 E	12	26	N	30	5 NM	26	0998.0	3.0	4.0	5	11.5	26	>13	32.5
ORIENTAL TAID	A8CV	16	36.9 N	142.6 E	18	36	N	48	1 NM	64	0994.0	10.0	6.0	6	10	36	6	14.5
GREAT OCEAN	JKJT	16	36.9 N	151.4 E	18	18	N	45	2 NM	80	0992.0	15.0	14.0	6	13	18	6	13
PRESIDENT JEFFERSON	WPSE	17	37.3 N	147.5 E	00	33		50	2 NM	02	0992.3	7.2	13.3	6	8	33	9	24.5
BARBER PRIAM	GYEV	17	36.9 N	151.9 E	06	29		43	5 NM	02	0991.5	8.8	14.0	4	10	28	< 6	21
SIMBA	GWEC	17	39.4 N	152.7 E	06	02	N	50	2 NM	07	0981.0	7.3	10.0	8	23			
EVER VALJE	H3NH	18	38.3 N	178.2 E	00	18	N	43	2 NM	02	1004.1	11.0	11.0	6	13	20	9	16.5
LAUREL	HBDE	18	46.9 N	178.8 E	00	12	N	50	50 YD	94	0983.0	2.0	7.0	10	14.5	11	9	14.5
TOYOTA MARU 12	JDJO	18	48.1 N	155.2 W	00	23	N	43	1 NM	60	0994.7	5.5	6.0	9	13	XX		
RED ARROW	SLTT	18	40.9 N	179.9 W	00	19	N	50	1 NM	63	0998.0	10.0	9.0	5	23	19	6	29.5
ALEUTIAN DEVELOPER	WIPL	18	53.7 N	134.4 W	12	14		45	10 NM	02	1010.2	8.3	6.7	4	10	18	8	16.5
MANHATTAN	WJAF	18	50.8 N	145.3 W	18	08		45	5 NM	02	0998.5	5.0	6.7	8	16.5	07	9	18
SEALAND INNOVATOR	WGKF	18	46.8 N	171.1 W	18	22	N	45	2 NM	07	0967.7	5.6	3.0		10	22		23
SEALAND PATRIOT	KHRF	18	43.3 N	177.0 E	18	26	N	50	5 NM	07	0986.0	5.0	5.0	9	18			
SEALAND PATRIOT	KHRF	19	43.7 N	179.7 E	00	27	N	50	5 NM	07	0988.0	5.5	5.0	9	19.5	27	10	19.5
SEALAND INNOVATOR	WGKF	19	47.1 N	176.6 W	00	22	N	65	2 NM	07	0963.5	4.5	4.0		10	22	8	29.5
SILVER PHOENIX	DSYA	19	44.1 N	177.3 W	00	26	N	54	5 NM	05	0984.4	6.0	4.0	26	32.5	26	10	13
RED ARROW	SLTT	19	43.4 N	169.5 W	12	25	N	50	10 NM	01	0997.4	8.0	7.0	6	24.5	25	6	31
SEALAND LIBERATOR	KHRP	20	42.5 N	149.4 E	18	10	N	42	5 NM	63	0993.5	3.5	1.0	14	13			
CALIFORNIA RAINBOW	JNJL	21	39.3 N	145.3 E	00	27	N	42	.5 NM	05	0992.0	10.0	13.0	4	6	27	9	13
PRESIDENT TAFT	WLDT	21	54.0 N	146.5 W	06	20		55	5 NM	62	0996.0	5.0	5.6	4	10	25	6	13
PRESIDENT CLEVELAND	KGYA	22	48.8 N	177.2 E	12	14		45	2 NM	91	1006.4	4.4	2.7	XX	10	14		11.5
PRESIDENT MC KINLEY	WYFZ	24	52.2 N	168.5 E	00	22		50	5 NM	02	1010.0	3.3	1.7	4	5	32	8	13
GARDENIA	A8UA	24	43.3 N	164.2 W	00	17	N	47	5 NM	02	1006.0	10.0	8.0	6	8	17	6	8
PRESIDENT TAFT	WLDT	24	51.6 N	172.0 E	18	32		50	5 NM	02	1006.5	2.8	2.8	4	10	32	9	16.5
PRESIDENT TAFT	WLDT	25	50.7 N	169.0 E	00	32		48	5 NM	02	1015.0	2.8	2.8	4	13	32	8	16.5
PRESIDENT TAFT	WLDT	26	43.7 N	152.8 E	12	18		45	.25 NM	45	1006.0	5.0	1.7	3	10	18	< 6	13
SAMUEL S	SLHX	27	50.5 N	163.4 E	00	18	N	50	1 NM	41	1003.0	4.0	2.0	10	14.5	18	10	14.5
SAMUEL S	SLHX	28	48.3 N	158.3 E	00	18	N	52	.5 NM	41	1004.0	3.0	1.0	10	14.5	18	10	14.5
DIAMOND PHOENIX	DSMS	29	51.5 N	144.1 W	18	02	N	43	> 25 NM	03	1010.0	10.5	7.0	11	6.5	02	< 6	6.5
DIAMOND PHOENIX	DSMS	30	51.1 N	142.1 W	00	02	N	58	1 NM	21	0992.0	5.0	7.5	6	16.5	07	9	19.5
SARGODHA	GUIU	30	42.0 N	143.3 W	00	26	N	43	10 NM	03	1012.0	11.0	6.0	5	8			
SEALAND PATRIOT	KHRF	30	46.6 N	148.1 W	06	31	N	42	5 NM	01	1009.5	9.0	7.0	3	11.5	05	8	10

* Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kn or waves ≥ 25 ft from May through August (≥ 41 kn or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest windspeed was selected.

U.S. Cooperative Ship Weather Reports

March and April 1981

SHIP NAME	VIA RADIO	VIA MAIL
ACE ENTERPRISE	5	14
ADRIAN MAERSK	19	58
AGUADILLA	85	125
ALBERT MAERSK	11	
ALLISON LYKES	7	
ALVA MAERSK	23	75
AMERICA SUN	20	130
AMERICAN APOLLO	36	68
AMERICAN ARROW	22	
AMERICAN CHIEFTAIN	22	64
AMERICAN HIGHWAY	23	
AMERICAN LEGACY	51	113
AMERICAN LYNX	28	158
AMERICAN TRADER	39	140
AMJR CAREER	16	47
ANNA MAERSK	39	69
ARCO ALASKA	51	62
ARCO JUNEAU	67	91
ARECIBO	42	29
ARNOLD MAERSK	18	64
ASIA BEAUTY	7	
ASIA HERON	10	
ATHEL LAADKI	5	
AUSTRAL ENVOY	28	84
AUSTRAL PURITAN	54	78
B T SAN DIEGO	14	190
BARBER TAIF	12	25
BARWA	12	104
BEISHU MARU	59	30
BIBB WMEC 31		5
BOGASARI DUA	15	
BOUTWELL WMEC 719	5	80
BRINTON LYKES	24	89
CALIFORNIA RAINBOW	66	72
CAPRICORN	9	
CHAPMAN	10	27
CHARLOTTE LYKES	31	
CHAUVENET T AGS 29	2	145
CHESHIRE	66	87
CHEVRON BURNABY	29	137
CHEVRON EDIMBURGH	30	103
CHEVRON LOUISIANA	8	49
CHEVRON PERNIS	6	37
CHEVRON WASHINGTON	49	133
CHRISTOPHER LYKES	1	
CK APOLLO	7	
COLOMBIA MARU	28	21
COMMON VENTURE	57	69
CONTRACT TRADER	1	
COURAGEOUS WMEC 622	25	31
CRYSTAL REEO	10	
DALLAS WMEC 716	1	
DAVID PACKARD		103
DECISIVE WMEC-629		44
DEL ORO	8	40
DEL VIENTO		1
DELTA BRASIL	8	
DIANA	37	26
DOCEANGRA	13	3
DONA MAGDALENA		124
DUBHE	15	
EASTERN FORTUNE	18	
EASTERN WISEMAN	15	
EIDANGER	1	
ELIZABETH LYKES	27	
ESSO BAYONNE	11	19
EURO-ASIA CONCORDE	9	
EVERGREEN WAGO-295	57	60
EXPORT CHAMPION	11	73
EXXON BALTIMORE	25	64
EXXON HOUSTON	35	52
EXXON PHILADELPHIA	29	59
FESTIVALE	1	
FRANCIS SINCERE NO 6	22	23
SAGE LUND	48	
SARDENIA	35	50
GLACIER WAGB 4	121	126
GLOMAR CHALLENGER	93	167
GOLDEN GATE BRIDGE	92	91
GRAND GLOBE	2	
GREEN AUKLET	29	
GREEN KOBE	16	32
GULF FARMER	7	
GULFQUEEN	1	
HANJIN SEOUL	1	
HECK ASV91		125
HILLYER BROWN	1	
HOESH MERCHANT	9	19
HOTAKA MARU	98	37
HOWELL LYKES	29	
IRIS QUEEN	78	
ITAPUCA	10	
JACKSONVILLE	17	39
JAMES LYKES	32	39
JAPAN APOLLO	52	60
JEAN LYKES	19	
JOHN LYKES	11	
KASHU MARU	53	54
KENNETH E HILL	53	120
KOLLGEIR	1	
KOREAN LEADER	3	12
KUNGSHAMN	1	
LAKE MENDOCINO	6	28
LASH ATLANTICO	26	97
LAVAUX	8	
LETITIA LYKES	20	
LLOYD CUIABA	1	
LUTZ SCHROEDER	25	
MALLORY LYKES		97
MANJAWILI	39	127
MANZANARES	21	
MARCONA TRADER	52	112
MARIA TOPIC	20	
MARITIME DOMINION	4	
MARJORIE LYKES	24	30
MAUI	69	149
MAYAGUEZ	42	135
MC ARTHUR		18
MENESTHEUS	29	76
MIDAS RHEIN	1	
MING GALAXY	26	20
MOBIL AERO	19	96
MOBIL POWER	21	43
MOBILOIL	12	50
ACONCAGUA	14	51
ADRIATIK	27	
ALASKA STANDARD	9	11
ALEUTIAN DEVELOPER	36	87
ALLTRANS ENTERPRISE	12	61
ALVINA	31	
AMERICAN ACCORD	34	74
AMERICAN AQUARIUS	25	85
AMERICAN ASTRONAUT	37	146
AMERICAN CORSAIR	31	115
AMERICAN LANCER	19	83
AMERICAN LEGEND	53	144
AMERICAN RACER	20	16
AMERICANA	6	23
ANCO STANE	54	
ANNIE JOHNSON	20	78
ARCO ANCHORAGE	69	93
ARCO PRUDHOE BAY	6	
ARGONAUT	20	45
ARTHUR MAERSK	12	76
ASIA BRAVERY	12	58
ASIA INDUSTRY	13	
ATLANTIC PIONEER	10	44
AUSTRAL LIGHTNING	32	62
AUSTRAL RAINBOW	60	110
BALD BUTTE	12	118
BARBER TOBA	11	
BASSWOOD WLB388	2	
BELLMAN	12	8
BLESS RIVER	20	61
BOHEME	33	62
BRAZOS	18	32
BROOKS RANGE	16	13
CALIFORNIAN	1	
CARNIVALE	42	50
CHARLES LYKES	56	134
CHARLOTTE MAERSK	6	20
CHEMICAL VENTURE	33	
CHESNUT HILL	47	167
CHEVRON CALIFORNIA	81	116
CHEVRON FELUY	2	
CHEVRON MISSISSIPPI	33	71
CHEVRON PERTH	1	196
CHIBA	49	106
CHUEN ON	11	93
CLARA MAERSK	20	39
COLORADO	3	
CONALCO	33	
CORAL ACE	15	
COVADONGA		60
CRYSTAL STAR	48	54
DART EUROPE	77	46
DAVID STARR JORDAN	11	13
DEFIANCE	27	46
DEL RIO	11	51
DELAWARE GETTY	24	81
DELTA CARIBE	15	8
DISCOVERER OSS	37	38
DOCTOR LYKES	30	119
DORIC	29	90
E. NORNSBY WASSON		105
EASTERN MUSE	47	
EASTERN WORLD	23	25
EL MEXICANO	7	
ENNA G	104	140
ESSO CASTELLON	42	64
EVER SHINE	37	39
EXPORT BANNER	16	
EXPORT FREEDOM		67
EXXON BANGOR	23	49
EXXON HUNTINGTON	5	42
EXXON SAN FRANCISCO	28	126
FFM MATARENGI	2	
FREDERICK LYKES	28	
GALLEON AQUAMARINE	6	46
GENEVIEVE LYKES	14	
GLACIER BAY	4	83
GOLDEN BEAR	30	71
GOLDEN PRINCE		78
GREAT LAND	78	97
GREEN FOREVER	63	35
GREEN VALLEY	10	
GULF MERCHANT	10	10
H J HAYNES	1	120
HARDANGER	3	
HELLESPONT GLORY	27	27
HOEGH CLIPPER	19	
HOESH MIRANDA	31	88
HOUSTON	9	44
INACHUS STAR	27	107
IRONWOOD WLB 297	6	
IVAN TOPIC	6	126
JADRAN	6	
JAMES M COOK	2	
JAPAN CADDO	14	53
JEFF DAVIS	3	
JOHN N COBB		34
KAUAI	55	144
KEYSTONER	67	166
KOREAN COMMANDER		18
KOREAN PRIDE	18	1
KURDBE MARU	42	19
LAKE PALOURDE	14	180
LASH ITALIA	13	63
LELAND I DOAN	1	
LEXA MAERSK	24	
LOUISE	47	144
LYNCH T-AGOR 7		125
MAMMOTH FIR	13	
MANUKAI	41	142
MARCHEN MAERSK	28	38
MARCONA TRANSPORTER	19	101
MARIA U	14	32
MARITIME HARMONY	17	
MASSACHUSETTS	6	
MAUMEE	4	25
MAYAYAN REEFER		54
MEADOWBROOK	7	29
MENINA ALICE	26	
MIDAS SEINE	12	
MING GLORY	28	
MOBIL ARCTIC	35	154
MOBILE MERIDIAN	43	111
MONMOUTH	2	
ADABELLE LYKES	15	
AFRICAN DAWN	25	
ALASKAN	24	65
ALGENIB	6	24
ALLTRANS EXPRESS	7	55
AMELIA TOPIC	2	
AMERICAN ACE	17	115
AMERICAN ARCHER	83	65
AMERICAN CHALLENGER	39	49
AMERICAN EXPLORER	24	20
AMERICAN LARK	32	85
AMERICAN LEGION	18	64
AMERICAN RANGER	32	118
AMOCO MILFORD HAVEN	9	29
ANCO TEMPLAR	130	
ANTE TOPIC	6	
ARCO CALIFORNIA	27	32
ARCO SAG RIVER	43	97
ARIES	12	43
ARYA MAN	1	
ASIA DALE	1	
ASIAN ASSURANCE	1	
ATLANTIC RAINBOW	34	119
AUSTRAL MOON	71	142
AXEL MAERSK	16	18
BALTIMORE TRADER	10	47
BARBER TONSBERG	2	
BAYAMO	28	
BERGLJOT	3	
BLUE OCEAN	44	78
BORINQUEN	33	72
BRIGHT HOPE	21	
BUILDER	1	47
CAMPBELL WMEC 32	8	
CELESTINO	2	
CHARLES PIGOTT		11
CHASE WMEC 718	5	6
CHEROKEE WMEC 165	1	20
CHEVRON ANTWERP	1	87
CHEVRON COLORADO	21	19
CHEVRON KENTUCKY	47	
CHEVRON NORTH AMERICA		80
CHEVRON ROME	1	
CHIKO	22	27
CITBUS WLB300	26	
CLIFFORD MAERSK	14	24
COLUMBUS AMERICA	41	128
CONCORDIA STAR	18	
CORNUCOPIA	21	119
CRESSIDA	48	129
D ALBERTS	18	18
DAVID D. IRWIN	12	14
DAVIDSON	5	9
DEL CAMPO	42	81
DEL SOL	8	
DELAWARE II	70	112
DELTA SUD	3	19
DITTE SKOU	19	47
DOLLY TURMAN	28	
DRUCILLA U	26	60
EAGLE	1	
EASTERN PACIFIC	15	26
EDGAR M QUEENY		15
EL PASO ARZEW	14	41
ERNA BLOEMENDORFF	21	
ESSO NASSAU	11	33
EVER SPRING	24	37
EXPORT BUYER	22	47
EXPORT FREEDOM	9	35
EXXON BATON ROUGE	10	38
EXXON NEW ORLEANS	3	6
FALSTRIA	42	111
FIREBUSH WLB 393	60	15
FRIENDSHIP	19	92
GALLEON ONYX	19	
GEORGE E KELEZ	41	19
GLADIOLUS	15	
GOLDEN DAISY	3	
GOLDEN RAY	10	
GREAT OCEAN		47
GREEN HARBOUR	23	42
GUADALUPE I	5	82
GULF SHIPPER	24	57
HANJUAN MARU	108	91
HARNGJIN	1	
HIEI MARU	121	60
HOESH DYKE	1	
HOESH OPAL	15	69
HOWARD G VESPER	6	75
INGER	28	110
ITALICA	9	21
J LOUIS	80	135
JALAYAMINI	9	
JAPAN ACE	84	26
JAPAN RAINBOW	15	16
JELA TOPIC	7	
JOSEPH LYKES	16	
KEIYO	30	97
KENDRA	35	39
KOREAN FIR	14	22
KOW ON	1	
L.V. FUNKHOUSER	1	132
LAKE SHASTA	17	51
LASH PACIFICO	19	31
LEO	14	12
LILLOOET	35	21
LOUISE LYKES	24	76
MAGDALENA	114	
MANHATTAN	25	95
MANULANI	43	108
MARCONA CONVEYOR	12	64
MARDI GRAS	24	28
MARINE CHEMICAL TRANSP	41	141
MARITIME INVESTOR	10	
MATHIESON	22	96
MAYA	1	
MAYO LYKES	2	50
MELLON WMEC 717	2	19
MEONIA	49	128
MIDGETT WMEC 726	3	8
MING MOON	39	23
MOBIL COMET	1	
MOBILFUEL	36	75
MONTERREY	4	
ADM WM M CALLAGHAN	12	58
AFRICAN STARS	3	30
ALBATROSS IV	62	
ALISA	1	
ALMERIA LYKES	32	
AMERICA MARU	82	40
AMERICAN ALLIANCE	24	115
AMERICAN ARGOSY	29	73
AMERICAN CHARGER	14	103
AMERICAN HERITAGE	2	68
AMERICAN LEADER	68	145
AMERICAN LIBERTY	26	78
AMERICAN RELIANCE	19	91
AMOCO VOYAGER		110
ANDERS MAERSK	23	72
ANTONIA JOHNSON	18	120
ARCO FAIRBANKS	58	89
ARCTIC TOKYO	1	47
ARILD MAERSK	21	69
ASHLEY LYKES	25	49
ASIA FLAMINGO	8	
ASIAN EXPRESS	25	114
AUSTRAL ENTENTE	3	31
AUSTRAL PIONEER	28	96
B T ALASKA	4	193
BARBER PRIAM	46	111
BARRANCA	100	116
BAYANO	32	
BERKSHIRE	83	
BLUEBIRD	93	
BOSTON	30	112
BRILLIANT STAR	10	
BUTTONWOOD WLB 306	10	
CAPE UPRIGHT		88
CHANCELLORSVILLE	26	87
CHARLESTON	41	127
CHASTINE MAERSK	12	26
CHERRY VALLEY	8	102
CHEVRON ARIZONA	68	120
CHEVRON COPENHAGEN	48	
CHEVRON LONDON		123
CHEVRON OREGON	1	7
CHEVRON SOUTH AMERICA	1	140
CHIKUMA	1	
CITY OF DUNDEE	2	
CLOVER	54	
COLUMBUS LOUISANA	42	
CONCORDIA SUN	11	23
COSMOS CAPELLA	1	
CRISTOBAL	6	75
DAFFODIL	7	18
DAVID P REYNOLDS	92	156
DE STEIGUER T-AGOR12	5	24
DEL MONTE	16	38
DEL VALLE	11	4
DELPHINA	1	
DIAMOND PHOENIX	34	117
DJATINEGARA	14	
DONA CORAZON II		71
DUANE	6	
EASTERN DIAMOND		237
EASTERN TREASURE	32	84
EDWARD RUTLEDGE	18	
EL PASO SOUTHERN	1	
ESSO BANGKOK	13	
ESSO SAINT JOHN	64	86
EVER VALUE	10	66
EXPORT CHALLENGER	13	62
EXPORT PATRIOT	8	81
EXXON FLORENCE	1	
EXXON NORTH SLOPE	28	50
FEDTRADE	10	
FORTUNSTAR	38	
FRISKY		83
GAMBHIRA	1	
GEORGE M KELLER	5	81
GLOBAL FRONTIER	19	77
GOLDEN GATE	14	36
GRACE	10	
GREAT REPUBLIC	9	23
GREEN ISLAND	26	38
GULF BANKER	4	9
GULF TRADER	5	18
HANJIN INCHEON	16	9
HARUNA MARU	127	91
HILCO SPRINTER	3	
HOEGH MASCOT	11	16
HOWSING BREEZE	39	36
HOWARD W BELL	3	52
IRIS ISLAND	9	62
ITALY MARU	66	91
J P GREY		33
JALAYAMUNA	2	
JAPAN AMBROSE	42	34
JARVIS WMEC 725	2	83
JOHN HENRY		49
JUTHLANDIA	18	102
KENAI	3	67
KOFUKU MARU	28	64
KOREAN JUPITER	4	32
KRPAN	4	
LAKE ARROWHEAD	21	48
LAKE TAHOE	28	92
LAUREL WLB290I	4	
LESLIE LYKES	20	23
LIONS GATE BRIDGE	130	62
LUIGI GRIMALDI	34	
MAHARSHI KARVE	18	
MANISTEE	14	
MANULEI	66	138
MARCONA EXPORTER	19	156
MARGARET LYKES	24	65
MARITIME BRILLIANCE	1	
MARITIME JUSTICE	19	
MATSONIA	44	118
MAYA PIONEER		39
MAYON	1	
MELVILLE	9	63
MERCY	23	31
MILLER FREEMAN	147	163
MING STAR	19	15
MOBIL LUBE		34
MOBILGAS		78
MORANT	68	

TOTAL WEATHER REPORTS RECEIVED FROM US COOPERATIVE OBSERVING SHIPS MARCH AND APRIL 1981

SHIP NAME	VIA RADIO	VIA MAIL
MORGENTHAU WMEC 722		49
MORMACDAWN	9	53
MORMACMOON	19	77
MORMACSTAR	24	83
MORMACWAVE	19	58
NANCY LYKES	27	
NEPTUNE CRYSTAL	14	
NEW JERSEY MARU	68	126
NOPAL BRANCO	9	31
NORSE PILOT	39	76
NORWAY	92	
OCEAN LOG	28	45
OGDEN FRASER	28	28
OJI GLORIA	56	32
ORCO MINER	1	
OREGON II	1	
ORIENTAL EXECUTIVE	17	47
ORIENTAL QUEEN	11	
ORUNDA	1	
OVERSEAS CHICAGO	10	14
OVERSEAS MARILYN	23	99
PACBARONESS	15	10
PACGLORY	8	
PACIFIC SAGA	46	116
PACMONARCH	11	
PACSTAR	29	
PANALLA	26	58
PEIRCE	11	
PERRYVILLE	6	54
PIONEER MOON	69	123
POLAR STAR WAGB-10	36	36
PRESIDENT ADAMS	23	16
PRESIDENT GRANT	59	93
PRESIDENT JEFFERSON	53	109
PRESIDENT MC KINLEY	58	112
PRESIDENT TRUMAN	19	42
PRINCE OF TOKYO	41	44
PROVINCIA DE EL ORO	8	24
QUINTINA	26	
REGENT CEDAR	48	58
RESOLUTE	20	55
RIO TEUCO	30	28
ROSE CITY	43	129
RUSH WMEC 723		64
SAM HOUSTON	21	
SAN JUAN	35	160
SANSINENA II	33	111
SANTA CRUZ	29	74
SANTA MAGDALENA	43	24
SARSOONA	15	54
SEA TRANSPORT	64	
SEALAND ECONOMY	32	100
SEALAND FINANCE	58	96
SEALAND INNOVATOR	74	146
SEALAND PATRIOT	53	116
SEALAND VENTURE	10	108
SEATRAIN TRENTON	49	
SEKI ROKANO	11	13
SHIRLEY LYKES	5	
SILVER LADY	1	
SIMBA	43	99
SINCLAIR TEXAS	11	25
SNOWDRIFT		52
SOUTH LIGHT	18	
SPERO	10	
STAR DOVER	46	154
STELLA LYKES	37	
STORIS WAGB 38	2	58
SVENDBORG MAERSK	11	56
TAMPA	75	151
TEXACO CONNECTICUT	1	
TEXAS	25	35
THOMAS S THOMPSON	43	82
THOMPSON PASS	8	36
TOLUCA	14	
TOYOTA MARU 10	156	84
TRANSCOLUMBIA	14	11
TSU	6	
UNIMAK WTR-379		36
UNIVERSE	4	
VAN HAWK	20	33
VERRAZANO BRIDGE	20	15
VIOLET	64	84
WASHINGTON WOOD	6	121
WESTWARD VENTURE	87	120
WISTERIA	42	36
WORLD HERCULES	4	10
YOUNG AMERICA	11	19
ZIM GENOVA	48	80
ATUZ	34	
BMDR	33	48
DSMC		16
DSZP	43	49
ELAJA		105
ELFY		79
HBFW	13	110
HBOE	68	19
HBVF	34	68
HPNI	9	50
JEUS	6	10
JREO	22	95
KFSZ		21
KPQS		74
KSLB	31	101
NBSZ	1	89
NDSI		8
S6EF		49
WDZB	32	101
WDZN220		19
ZCUT	31	72
6LUB	32	178
6NUE	37	169
6KEF	30	21
9VXU	2	68
NORMAC BAY	1	
NORMACDRACO	18	43
NORMACRIBEL	6	41
NORMACSUN	13	
MOUNT VERNON VICTORY	21	
NAVASOTA		22
NEPTUNE DIAMOND	33	105
NEW JERSEY SUN	5	6
NOPAL LANE	3	
NORTH STAR III	5	17
NURA DEL MAR	12	
OCEANIC	137	168
OGDEN JORDAN	45	50
OLEANDER	83	107
ORCO TRADER	28	
ORIENTAL CHAMPION	27	29
ORIENTAL EXPORTER	49	83
ORIENTAL SOVEREIGN	36	39
OTTO N. MILLER		144
OVERSEAS HARRIET	1	
OVERSEAS NEW YORK	20	10
PACDUCHESS	16	9
PACIFIC ARROW	100	83
PACIFIC VENTURE	91	200
PACNOBLE	20	24
PAN ASIA	1	2
PASSUMPSIC AO-107		72
PENNMAR	4	41
PHILADELPHIA	52	90
POINT MARGO	13	
POLYNESIA	71	176
PRESIDENT CLEVELAND	39	78
PRESIDENT HARRISON	4	57
PRESIDENT JOHNSON	89	114
PRESIDENT PIERCE	46	123
PRESIDENT TYLER	81	174
PRINCE WILLIAM SOUND	2	26
PUNTA MALVINAS	4	
QUIKADA	43	49
REGINA CELI	2	
RESOLUTE WPC 620	12	
ROBERT E LEE	14	43
ROYAL VIKING SEA	4	12
RUTH LYKES	25	20
SAMOA	68	84
SANKOSTAR	10	
SANTA ADELA	5	51
SANTA ELENA	41	76
SANTA MARIA	28	64
SCANDINAVIAN HIGHWAY	32	25
SEALAND CONSUMER	43	69
SEALAND ENDURANCE	30	79
SEALAND FREEDOM	68	119
SEALAND LEADER	17	112
SEALAND PIONEER	5	20
SEALIFT ANTARTIC	30	63
SEATRAIN YORKTOWN	38	128
SEPTA	21	49
SHUNWIND	98	3
SILVER PHOENIX	20	6
SINALOA	48	74
SKAUGRAN	73	423
SOCONY VACUUM	32	21
SOUTHERN CROSS	7	
SPRAY DERRICK	14	
STAR HONGKONG	19	
STOLT LLANDAFF	2	
SUGAR ISLANDER	46	118
SWEETBRIER WLB 405	50	
TAURUS	3	29
TEXACO GEORGIA	1	
TEXAS TRADER	3	63
THOMAS NELSON	9	74
TILLIE LYKES	51	137
TONCI TOPIC	1	73
TOYOTA MARU 12	99	140
TRAVIATA	12	19
TUBUL	6	
UNION PROGRESS		48
UNIVERSE KURE	69	87
VAN TRIUMPH		110
VICTORIA U	1	
WALCHAND	1	
WESER EXPRESS	134	164
WHITING	6	
WOERMANN SASSANDRA	46	
YANUMOKAWA MARU	32	25
YOUNG SCOPE	29	73
ZIM HONGKONG	3	
ARLW	30	27
CBMD	19	63
DSQC	20	37
DTEN		3
ELAK	9	32
ELIJ	27	22
H3LI	15	27
HBGO	18	86
HBXF	6	10
H9NR	4	7
JMVI	13	31
JUWM	5	8
K6JF	48	148
KSFJ	32	104
KVKN		42
NDCV	77	104
NVBK		28
S6GZ	46	137
W6JF	60	130
WYK3261		101
3EDB	8	7
5NMP	12	14
5NYK	100	140
9VWG	18	37
MORMACALTAIR	34	60
MORMACGLEN	3	18
MORMACSAGA	13	53
MORMACTIDE	15	89
MT MITCHELL	76	171
NEEMES	86	95
NEPTUNE JADE	27	
NEWARK	55	104
NORDHVAL	4	
NORTHERN VICTORY	13	103
OCEAN CROWN	9	
OCEANOGRAPHER	60	95
OGDEN THAMES	9	28
OLGA TOPIC	15	119
ORE JUPITER	13	
ORIENTAL COMMANDER	23	
ORIENTAL LEADER	5	17
ORIENTAL STATESMAN	19	44
OVERSEAS ALEUTIAN	11	
OVERSEAS JOYCE	5	18
OXFORDSHIRE	1	
PACDURE	15	
PACIFIC ERA	91	109
PACMAJESTY	8	33
PACPRINCE	26	12
PAN DYNASTY	7	
PAYSANDU	22	78
PEREIRA D'ECA	1	
PINK SKY	9	
POLAR ALASKA	5	34
PORTLAND	72	104
PRESIDENT FILLMORE	57	140
PRESIDENT HOOVER	80	154
PRESIDENT KENNEDY	20	78
PRESIDENT TAFT	74	147
PRESIDENT VAN BUREN	44	109
PROSPERITY	16	
PURE OIL	2	36
R G FOLLIS	5	35
RELIANCE WMEC 615	2	33
RENTIER	29	17
RODRIGUES CABRILHO	13	
ROYAL VIKING SKY	16	
SACRAMENTO	1	
SAMUEL S	18	17
SANKOSTEEL	8	26
SANTA BARBARA	9	13
SANTA FE	16	29
SANTA MARIANA	26	100
SCILLA	13	
SEALAND DEFENDER	52	39
SEALAND EXCHANGE	6	15
SEALAND GALLOWAY	45	120
SEALAND MARKET	23	78
SEALAND PRODUCER	10	103
SEATRAIN INDEPENDENCE	58	25
SEATTLE	14	37
SEVEN OCEAN	21	5
SIENA	26	
SILVERLINE		48
SINCERE NO 3	7	12
SKAUGRAN	24	90
SONIO INTREPID	36	134
SOUTHWARD	14	11
STADT BREMEN	10	
STARWARD	57	81
STOLT LLANDAFF	44	81
SURVEYOR	104	121
TAINO VENTURE	16	
TENNESSEE	2	24
TEXACO MARYLAND	1	
TFL DEMOCRACY	17	73
THOMAS WASHINGTON	22	113
TOMBEI MARU	32	7
TRNAINA	29	100
TOYOTA MARU 83	114	78
TRIUMPH	43	49
TYSON LYKES	49	110
UNICUE FORTUNE	19	
VALLEY FORGE	19	6
VANGUARD	14	32
VIENNA WOODS	39	37
WALTER RICE	57	160
WESTERN HIGHWAY	79	71
WILLIAM E MUSSMAN	14	53
WOODBUSH WLB407	1	
YAMASHIN MARU	104	109
YOUNG SEAGULL	20	48
ZIM MONTREAL	24	78
ARWA	41	129
DSAN		14
DSSG	8	90
DRCB		63
ELAMA		9
ELKT	60	110
H3SY		58
H8LR		48
H9HU	7	34
H9PY	13	23
JMZR	29	93
KA8285	75	128
KHRP	55	129
KSFK	26	59
LICX		34
NMRE		13
OZBS	14	24
VRGO	72	59
WICO		29
WYKN288		92
4RLZ	45	55
5WNL		6
6ZRT	27	64
9VND	27	44
NORMACARGO	18	
NORMAELYNE	28	84
NORMACSEA	8	
NORMACVEGA	26	72
NASARA	18	31
NEPTUNE AMBER	29	68
NEW GOLDEN PHOENIX	66	
NOORAMY	67	106
NORDIC LOUISIANA	93	
NORTHWIND WAGB 282	4	
OCEAN DUKE	6	11
OCTA	61	134
OGDEN WILLAMETTE		32
ORANGE	73	
ORE MENDIXEN	30	
ORIENTAL ESEARCHER	36	22
ORIENTAL MERCHANT	39	44
ORIENTAL TAID		112
OVERSEAS ARCTIC	10	43
OVERSEAS JUNEAU	38	91
PACBARON	17	21
PACEMPEROR	29	
PACIFIC PEACE	5	134
PACMERCHANT	4	
PACPRINCESS	15	
PAN WESTERN	17	10
PEARL SEA	1	
PERENNIAL ACE	65	330
PIONEER CONTENDER	13	62
POLAR SEA	226	120
POTOMAC	33	82
PRESIDENT GARCIA	12	59
PRESIDENT JACKSON	34	15
PRESIDENT MADISON	27	113
PRESIDENT TAYLOR	26	35
PRESIDENT WILSON	18	36
PROSPERITY QUEEN	20	89
QUEENS WAY BRIDGE	117	73
RED ARROW	24	97
RESEARCHER	73	94
RICHARD	42	64
ROSE		143
ROYAL VIKING STAR	4	
SALVADOR	5	3
SAN NO MARU	1	
SANKOSUN	12	
SANTA CLARA	15	46
SANTA JUANA	6	16
SANTA MERCEDES	33	48
SEA LAND VOYAGER	49	93
SEALAND DEVELOPER	84	111
SEALAND EXPRESS	31	58
SEALAND INDEPENDENCE	36	77
SEALAND MCLEAN	19	36
SEALAND RESOURCE	39	82
SEATRAIN ORISKANY	23	113
SEDGE WLB 402	17	
SHELDON LYKES	28	
SILAS BENT T-AGS 26	1	
SILVERPLANE	8	29
SINCERE NO 5	8	
SKYWARD	32	48
SOLOK TUMPAN	20	46
SOUTHWEST CAPE	3	
STAR DIEPPE	33	
STEADFAST WMEC 623		45
STONEWALL JACKSON	5	16
SUSQUEHANNA	32	44
TALISMAN	12	
TERRIER	4	22
TEXACO RHODE ISLAND		21
TFL FREEDOM	27	67
THOMPSON LYKES	12	
TOKYO RAINBOW	17	86
TOWNSEND CROMWELL	108	125
TRENTSEULDRAED	13	37
TROPICANA	12	
ULTRASEA		18
UNITED SPIRIT	17	139
VAN FORT	1	
VELMA LYKES	30	
VIGOROUS WMEC-627	14	77
WASHINGTON TRADER	43	111
WESTERN SUN		72
WILMINGTON GETTY	89	127
WORLD EXPEDUN	18	38
YOCONA WMEC 168	10	
YUKON T-AO 152	35	115
ZOELLA LYKES	3	
A8ZW	22	103
DSCN	15	70
DSVT	24	68
ELAOA	3	274
ELCJ	29	103
ELYM	27	64
H8AD	2	11
H8RD	16	74
HPIB	13	7
JCUF	39	46
JPWD	44	32
KFBT		11
KPEL	22	49
KSDH		9
LRQB	12	17
NMBN		479
S6LN	4	83
WCIV		18
WLFH	1	89
WZL8190		32
5LEV		33
9MDJ	15	19
9LDN	19	12
9VUG	4	28

SUMMARY: GRAND TOTAL VIA RADIO 23439 GRAND TOTAL VIA MAIL 47187

Rough Log, North Atlantic Weather

June and July 1981

ROUGH LOG, JUNE 1981--The tracks of this month's major cyclones did not match climatology very well. In fact, there was no favorite path. The majority of the cyclone centers were north of 35°N and west of 30°W. Early in the month a storm tracked from off New York to across Scandinavia. Several storms tracked from the Gulf of St. Lawrence toward southern Greenland. During the first 2 weeks of the month, several storms paralleled latitude 40°N from south of Nova Scotia to midocean. There were only three significant cyclones in the area between longitude 30°W and the European coast, and all were in the first week. Two affected the Mediterranean.

The mean sea-level pressure chart was very different from climatology. The only part of the pattern that was comparable was the central pressure of the Azores High (1023 mb) near 30°N, 30°W, and westward to the coast of the United States. The Icelandic Low did not exist. There were two 1009- and 1010-mb Low centers in the area from Scandinavia to Spitsbergen. There were also 1008-mb Low centers over Quebec Province and eastern Hudson Bay. The Azores High had a neck (ridge) that extended northeastward to the Brest Peninsula.

There were no major anomaly centers, but many small ones. There were negative anomalies over Scandinavia to Spitsbergen and from Canada to northwest of the Azores. The area from the North Pole to Greenland to France was positive.

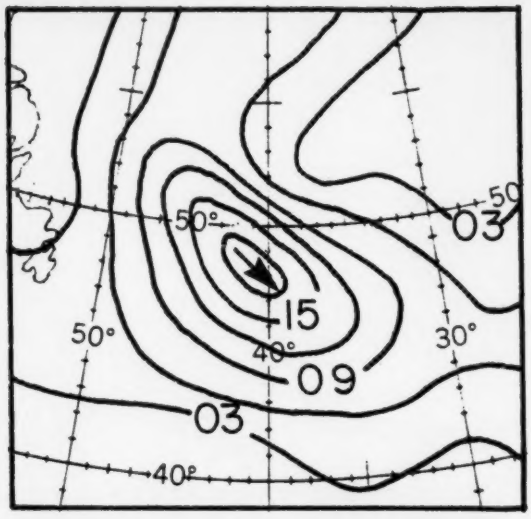
The upper air at 700 mb was different from the normal pattern. The primary Low was shifted southward to Mansel Island in Hudson Bay, and the long-wave trough extended southeastward along the Labrador coast to midocean. There was a short-wave trough to the south from Nova Scotia. A ridge paralleled longitude 20°W with another displaced Low over Spitsbergen with a trough paralleling longitude 10°E. The usual short-wave trough was off the Portuguese and Moroccan coasts.

Tropical storm Brett formed the last day of the month.

Extratropical Cyclones--This cyclone was on the charts off Portugal on the first chart of the month. It traveled northward along longitude 13°W. By 1200 on the 2d it was 994 mb near 52°N, 13°W. Several ships had gales south of the center. The STRATHEDEN (36°N, 11°W) reported 50-kn winds. Another ship near 48°N, 15°W, had 52-kn winds with 13-ft waves, while another near 49°N, 12°W, had 18-ft seas. The storm was shrinking on the 3d and disappeared on the 4th.

This LOW was over the Strait of Belle Isle on the 1st. By late on the 2d ships east of Cape Race found 40-kn winds. A German ship (51°N, 46°W) had 39-kn and 13-ft waves. On the 3d the 988-mb storm was near 54°N, 34°W. A Soviet ship near 52°N, 44°W, had 48-kn winds at 1200. The ATLANTIC CAUSEWAY (48°N, 34°W) had 40-kn winds with 20-ft waves.

At 0000 on the 4th OWS CHARLIE had 18-ft swell waves. The LOW was either retrogressing or making a loop at this time. The Soviet ship ESRF reported



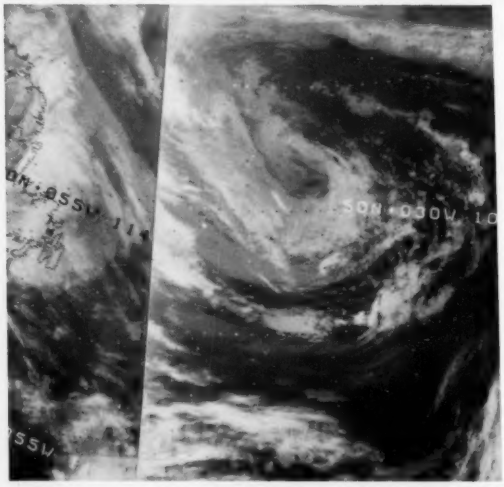


Figure 40.--The wind-wave analysis for 0000 on the 4th and the satellite image for 1145. The infrared image shows only low and middle clouds, indicating a rather shallow storm.

48-kn westerly winds near 51°N, 43°W, with 20-ft seas and was indicated in the wind-wave analysis (fig. 40). A Danish ship was at 59°N, 43°W, at 0600 with 44-kn winds and 26-ft waves. There were several gale reports south of the center at 1200. The storm was weakening on the 5th, but the JEFFERSON (48°N, 30°W) had 16-ft seas and 26-ft swells with gales. The cyclone could no longer be found after the first chart on the 6th.

While this was a long-lived cyclone, it did not last long after it reached the Atlantic. It can be traced from the Bering Sea on the 1st. It traveled southeastward across Canada and was over Anticosti Island on the 7th. There was a gale report near the front off Norfolk. There were gales in the southeasterly flow on the 8th with the SEDCO reaching 44 kn.

The front was swinging far out of the LOW, which had slowed, on the 9th. Late in the day another center formed to the east, and by late on the 10th this circulation did not have a center.

Monster of the Month--This circulation formed on an occluded front over the St. Lawrence Basin on the 9th. The previous LOW was dissipating, and this one developed rapidly in its wake. The SCOTTISH LION near 38°N, 67°W, had winds between 30 and 45 kn and 20-ft waves. The speed barbs were obscured by other parts of the plot. Canadian ships to the north had 35- to 40-kn winds. The CJR6 (44°N, 60°W) reported 45-kn winds with 15-ft waves. The 980-mb storm was over Cape Race at 0000 on the 11th.

By 1200 on the 12th this 972-mb storm was near 51°N, 37°W (fig. 41). Its cyclonic circulation extended from Newfoundland to Ireland and 30°N to 65°N. Lima measured 48-kn east-southeasterly winds raising 20-ft seas with 23-ft swells. The OGDEN THAMES (48°N, 36°W) was sailing southwestward into 43-kn winds with 25-ft seas and swells. Most ships with high winds were reporting gales. On the 13th the SUDURLAND (63°N, 21°W) had 52-kn easterly winds. The Soviet URYD (53°N, 27°W) found 43-kn southwesterly winds with 23-ft seas. Charlie had winds near 40 kn and seas over 20 ft on the 14th. The storm was rapidly losing strength as high pressure built to the south. On the 0000 chart of the 15th another LOW was found 600 mi to the east. Twelve hours later the new cyclone had taken over.

The remainder of the month the storms were kept well to the west as high pressure moved northward and eastward.

The path of this LOW was directly affected by high pressure west of the English Channel. The cyclone formed over the Mississippi Valley late on the 21st. By the 23d its southerly circulation was off the east coast and a ship near 36°N, 70°W, found 28-ft swells out of the southwest. The SEDCO recorded gales. The storm was traveling down the St. Lawrence River Valley and at 0000 on the 24th was 988 mb north of Sept-Isles (fig. 42). At this time there was a 1032-mb HIGH centered about 600 mi west of Ireland, a 1025-mb cell over Iceland, and a 1028-mb cell about 600 mi southeast of Cape Race. The OCEA at 48°N, 50°W, reported 44-kn winds. Later in the day a SHIP (49°N, 43°W) found southerly 48-kn winds near the warm front. The LOW crossed the Labrador Sea and

Figure 41.--The low center was near 52°N, 37°W, at 1023 according to the cloud shield. The high clouds (bright area) are north of the occlusion centered over OWS Lima.

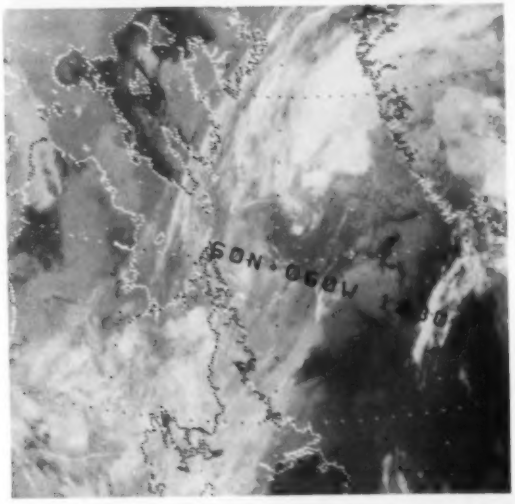


Figure 42.--At 1230 the storm appears to be centered near 61°N, 59°W, farther north than shown on the analysis. There is only a narrow band of clouds along the front as it pushes against the strong high-pressure ridge.

crashed against the southwest coast of Greenland and disintegrated. The AMERICAN LEADER was between the front and the HIGH with 21-ft swells.

The HIGH persisted west of Ireland and on the 25th a front developed over western Europe. Frontal waves formed on the front on the 26th and traveled northeastward. As they moved over the Low Countries and Scandinavia, the gradient was increased over the North Sea causing gales and high waves for the many ships and rigs--the highest being about 45 kn and 20 ft. On the 27th the gradient relaxed as the front drifted eastward.

Tropical Cyclones--On the 29th a low-pressure system developed about 150 mi east of Cape Hatteras. This was the beginning of tropical storm Brett. On the 30th a reconnaissance aircraft found the second tropical storm of the season some 120 mi east-northeast of Cape Hatteras (fig. 43). Brett was moving west-northwestward at about 12 kn. Highest sustained winds were about 50 kn in squalls near the 997-mb center. Gales extended outward 100 mi. By midnight on the 1st Brett was about 40 mi east of Norfolk. Several hours later a rapidly weakening storm moved inland across the Virginia coast and southern Chesapeake Bay. Two pleasure boats, the 43-ft yacht PATRIOT and the 40-ft VALIANT LADY, were caught in the storm and the subject of a search by the Coast Guard.

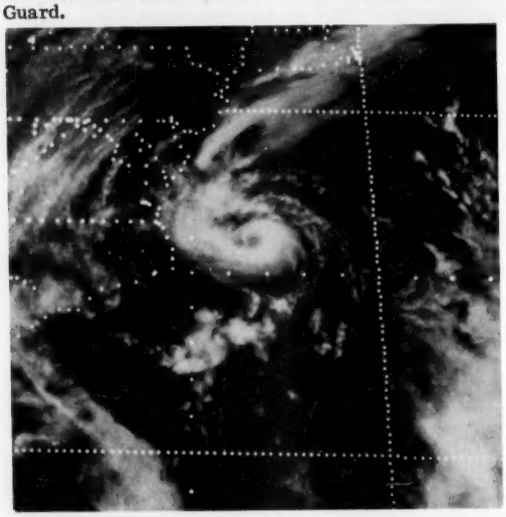


Figure 43.--Tropical storm Brett at 1700 on the 30th, a small storm.

Casualties--Fog was the biggest culprit this month. The first day of the month the MAJORCA struck a rock while approaching St.-Malo in fog. The STELLA SCARLETT ran aground in fog on the 2d at Malmo port entrance. The 999-ton SLOMAN RANGER and the 10,673-ton ARTEMIS ISLAND collided in fog 100 mi off Cartagena on the 12th. The SLOMAN RANGER capsized with four crewmen missing. On the 13th the 38,826-ton TITAN and the 5,069-ton TALAVERA collided in fog in the English Channel. The same day the ferry LION made contact with the Eastern Arm at Dover in fog.

The morning of the 16th the 15,644-ton GOOD CAPTAIN and the 13,074-ton CHARITY collided in fog south of Sicily. The CHARITY sank with all rescued.

On the 14th the wooden motor fishing vessel SERIOUS BUSINESS hit a reef off southern Jamaica and caught fire. The crew spent the night in a liferaft in heavy seas and thunderstorms.

The KAPETAN ANDREAS grounded at Great Inagua Island in poor visibility on the 16th. The KAPTAI contacted the lockwall at Beauharnois Lock in squally weather on the 26th.

Other Casualties--The ANGELINA was reported as having sunk off Montevideo as a result of heavy-weather damage. The ALMIRANTE STORNI contacted the TWIN SAPPHIRE while berthing in strong winds in Montevideo. The SEA ROVER was at Cape Town repairing heavy-weather damage sustained in June.

ROUGH LOG, JULY 1981--This was a quiet month even for a summer month. There were probably the normal number of cyclones, but they did not develop especially high winds or waves. There was no concentrated track that the cyclones followed. In general those storms that influenced the U.S. East Coast and the Maritime Provinces were on a northeast track and dissipated south of Greenland. The storms out of central Canada had an east-southeasterly track. They also tended to dissipate near Greenland. The storm centers were north of a line from northern Florida to Ireland.

The controlling feature on the mean monthly pressure pattern was the Azores High at 1029 mb near 41°N, 25°W. This was 4 mb higher and 700 mi northeast of its normal location. There were several low-pressure centers basically north of 60°N. The deepest was 1006 mb near Prince Charles Island in the Foxe Basin. There was a 1007-mb center west of Kap Farvel, a 1008-mb center east of Iceland, and a 1009-mb center near the north end of the Gulf of Bothnia. These matched climatology fairly closely.

The largest anomaly center was plus 6 mb near 40°N, 20°W. There were several minus 2 to 4 mb centers north of a line from Cape Race to Stockholm.

The upper air pattern was primarily zonal over the water with slight ridging over midocean. The long-wave trough off the North American east coast was farther east than usual, particularly over the Labrador Sea. The long-wave trough over central Europe was also shifted eastward about 10° longitude.

Short-lived tropical storm Brett formed the last day of June but only survived 1 day of July.

Extratropical Cyclones--A cold front was moving across the Labrador Sea on the 1st with a weak frontal wave. The 998-mb center was south of Iceland on the 3d with a few gales. The WALDHORN and the DLBB had gales south of the center. A Canadian ship near Belle Isle had 44-kn westerlies. The storm was stationary near 58°N, 25°W, from about 1200 on the 3d (fig. 44) to 1200 on the 4th, when the pressure was 985 mb. Several ships had gales. One near 61°N, 35°W, had 21-ft swells, and a ship south of the LOW had 20-ft swells. The storm had dissipated by the 7th between Iceland and the Faeroe Islands.

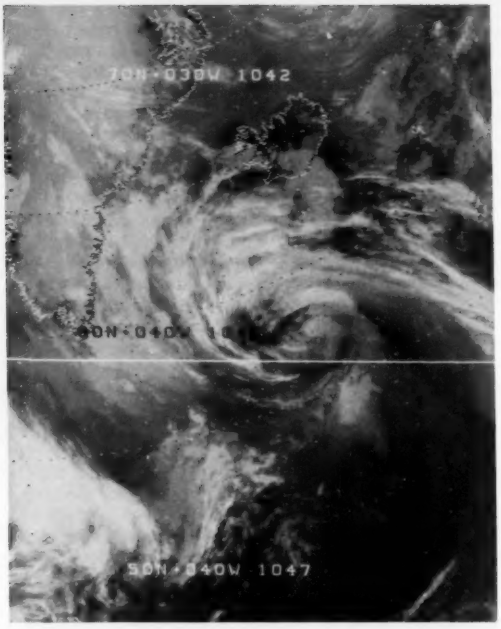


Figure 44.--At this time on the 3d the only low and middle clouds are indicated by infrared.

This storm tracked across Hudson Bay then turned southeastward. It was 986 mb over the Labrador Sea on the 4th. The BEN OCEAN LANCER had 40-kn winds near Hamilton Inlet, and the OCEA had the same off Cape Race. This storm was closely following the previous storm and producing a few gales. The C.P. VOYAGER reported 35 kn and 16-ft waves on the 5th and 6th near 53°N, 45°W. The LOW was 992 mb near 56°N, 30°W, at 1200 on the 6th. It turned northeastward on the 7th and started weakening. The LOW survived until the 10th.

Monster of the Month--This storm formed near Lake Winnipeg on the 7th. The storm was over Cape Race at 1200 on the 9th. A Canadian ship in Cabot Strait had gales at the beginning of the day. By 1800 SEDCO had 48-kn southwesterly winds with 20-ft seas. The storm passed nearly directly over the platform about that time. By 0000 on the 10th the winds had switched

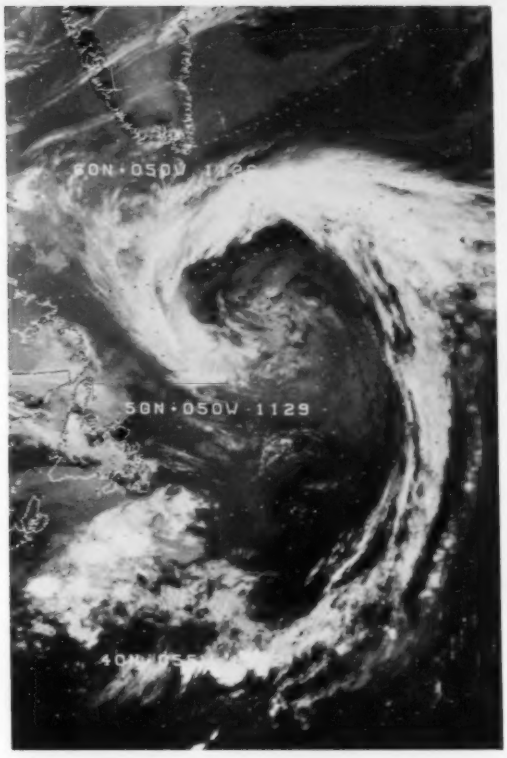


Figure 45.--The low clouds near the center are jumbled together. The cloud west of the center is indicative of an area of instability.

to the northwest at 50 kn. About 15 mi away the ZAPATA registered 39 kn. The storm was 976 mb by 1200 near 53°N, 41°W (fig. 45). Three ships within 100 mi of each other, at approximately 50°N, 39°W, had 37- to 45-kn winds and seas up to 23 ft. Among them was the AMERICAN ALLIANCE.

On the 11th the storm was tracking northwestward toward Kap Farvel. OWS Charlie had waves up to 20 ft. The WALTHER HERWIG was fishing near Kap Farvel with 54-kn northerly winds in 21-ft seas. On the 12th another low center moved into the area and took over the circulation.

This cyclone was first noted over western Canada on the 7th. It traveled northeastward, then turned southeastward on the 9th and drifted slowly over Hudson Bay. The FREDERICK CARTER in Cabot Strait had 40-kn winds from the southeast on the 14th. The storm was over Cabot Strait on the 15th. At 1800 SEDCO measured 54-kn winds from the southeast. The winds in that area continued in the strong-gale to storm category into the 16th. The storm was traveling northward at 992 mb. It fell apart on the 18th.

The North Atlantic was rather quiet for the remainder of the month. The Azores High was firmly embedded in the vicinity of 45°N, 25°W. A ridge extended south-

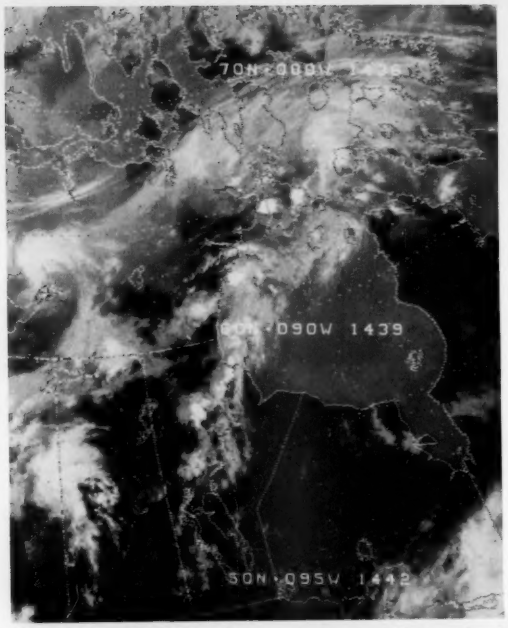


Figure 46.--The storm does not look as well organized on this infrared image as on the weather analysis. At this time it was centered over the northwest shore of Hudson Bay. Thunderstorm activity can be seen along and south of the front.

westward to the southeastern United States with a lesser center southeast of Bermuda. Short-lived frontal waves moved against this high pressure and were defeated. There were a few isolated gales reported here and there. This, of course, left the sea quiet.

This storm was one of the strongest of the month, but it involved only a very few ships in Hudson Strait. The storm came off the Beaufort Sea on the 26th and by 1200 on the 28th was 992 mb centered over the northwest shore of Hudson Bay (fig. 46). The first high wind report was at 0600 with the call letters CCGS of 43-kn winds from the southwest near 62°N, 75°W. At 1800 the PIERRE RADISSON also near 62°N, 75°W, had 55-kn southwesterly winds. The ships were apparently at the small Port of Deception. At 0300 on the 29th the PIERRE RADISSON reported southerly 60-kn winds. Later on the 29th the winds decreased to 40 kn.

By 0600 the winds had again picked up to 50 kn. The DISKO at 70°N, 54°W, radioed winds of 37 kn. Upernavik, Greenland (73°N, 56°W) measured 45-kn southerly winds. On the 31st a ship with Soviet call letters near 69°N, 70°W, reported 45-kn winds. The storm had weakened rapidly and the isolated land stations were reporting winds of about 10 kn.

Casualties--Fog and thunderstorms were the main culprits this month. The 1,199-ton Hungarian TATA ran against a jetty at Kimolos during bad weather on the 3d. The GRETHE DANIA sank in dense fog on the 10th off the Netherlands. The Icelandic BERGLIND and the Danish CHARM collided in fog off Louisburg on the 20th. The BERGLIND sank off Glace Bay while being towed. No lives were lost. The CHRISSI AMMOS II was stranded in bad weather off Mykonos and refloated. A violent thunderstorm blew the KOCKCROW against a pier at Norfolk on the 21st. The pier was damaged and the ship went aground.

Lightning struck the 59,060-ton Japanese tanker HAKUYOH MARU at Genoa. The tanker had just finished unloading and exploded. Burning oil caused a fire on the INDUSTRIAL PROSPERITY, which was quickly extinguished. Burning oil on the water hampered fire and rescue services. Five persons were killed and 10 injured.

Other Casualties--The AEGIS HARVEST broke tow in heavy weather 26 mi southeast of Cape Receife on the 11th. The Japanese submersible pontoon KDG 1502 with the drilling platform SABINE IV on board broke the towing wire on the 24th in a force 10 storm about 60 mi from Port Elizabeth. The WESTAFTRADER and ITAQUATIA collided in misty weather in the outer roads of Santos, Brazil, on the 31st.

Rough Log, North Pacific Weather

June and July 1981

ROUGH LOG, JUNE 1981--This was a quiet month with no especially severe extratropical cyclones. There were fewer cyclones than normal this month, except over the Gulf of Alaska. There were two lightly traveled tracks over the western ocean, one from off northern Honshu eastward to the vicinity of longitude 170°E and the other from about 600 mi southeast of Tokyo eastward to midocean and then northeastward into the Gulf of Alaska. Contributing to the cyclones over the Gulf of Alaska were some that formed in the area or came out of the Bering Sea.

The major sea-level pressure feature was the 1025-mb Pacific High, which was normally located near 35°N, 140°W. The usual ridge into the Seattle area was slightly stronger than normal. The 1010-mb Aleutian Low was found over the Gulf of Alaska south of the Semidi Islands rather than north of Adak Island. There were two anomalous 1017-mb high-pressure centers in the northern latitudes, one near Agattu Island in the Aleutians and the other near Ostrov Paramushir in the Kurile Islands.

The two anomalous high-pressure centers both produced plus 5-mb anomaly centers. The Aleutian

Low over the Gulf of Alaska resulted in a minus 4-mb anomaly center near 50°N, 140°W.

The upper air pattern at 700 mb was displaced in much the same way as the surface. The LOW was south of the Alaska Peninsula rather than north of Adak Island. There was a high center over Kamchatka and a small cut-off HIGH in the ridge over southeastern Alaska. The zonal flow was primarily between latitudes 30° and 40°N over the western ocean and between latitudes 35° and 50°N over the eastern ocean.

There were four tropical cyclones over the North Pacific, tropical storm Ike and typhoons June and Kelly over the western ocean and hurricane Beatriz over the eastern ocean.

Extratropical Cyclones--This LOW formed in a col over the Sea of Japan between two high-pressure systems and north of a frontal wave. By 0000 on the 3d the cyclone was over the Kuroshio Current and deepening. The FRANCIS SINCERE was almost in the center of the storm (41°N, 151°E) with 36-kn gales from the east and 25-ft waves (fig. 47). At 1200 the CLOVER was south of the center with gales and 20-ft waves. The storm was traveling slightly north of east with light winds.

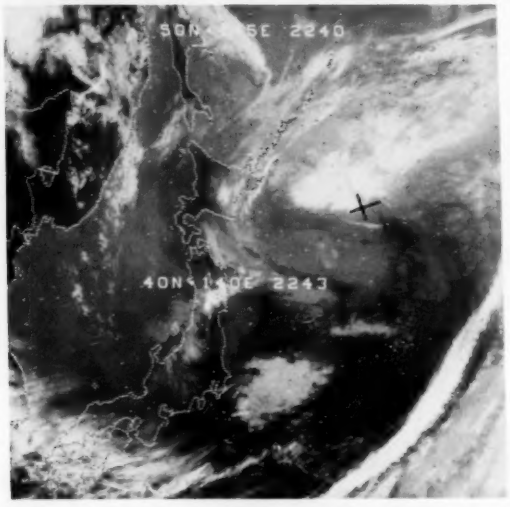


Figure 47.--The + marks the position of the FRANCIS SINCERE at 0000 on the 3d. At 2243 on the 2d the surface center of the storm was not discernible by satellite. Ship observations remain ground truth and are not replaceable.

On the 8th the storm was approaching the Washington coast. The ARCO JUNEAU was near Cape Blanco with 35-kn gales. On the 9th the storm no longer existed.

On the 12th the Pacific High was moving toward the California coast causing an increased gradient along the coast. Several ships found gales to strong gales. The WALTER RICE (36°N, 123°W) found 40-kn northwesterly winds with 23-ft waves. On the 14th the NWPB had 44 kn. A few miles away a Soviet ship had 20-ft waves. The gradient relaxed on the 16th.

On the 11th a front that roughly paralleled latitude 30°N stretched from China to the United States. A weak wave was analyzed south of Japan at the time. On the 13th the storm was east of Hokkaido. The CANADIAN HIGHWAY (38°N, 155°E) found 38-kn winds. The storm was 988 mb near 45°N, 162°E, by 0000 on the 14th. The YOUNG SPLENDOUR and the H9NG, both near 42°N, 171°E, had 45-kn winds with the waves reaching 12 ft. At 1800 a ship near 46°N, 175°E, east of the occlusion had 40-kn winds and 20-ft seas.

On the 15th a new LOW formed at the point of occlusion and sped off to the east. A Japanese ship reported 20-ft waves south of the LOW. A Panamanian ship near the Date Line and 38°N had 45-kn winds, while another ship reported 23-ft waves.

The PRESIDENT TRUMAN was north of the new cyclone on the 16th with 45-kn winds and 25-ft waves. The winds were 50 kn and the waves 26 ft at 1200. The swell was 33 ft at 1800 (fig. 48). The NEW GOLDEN PHOENIX was north of the original storm with 48 kn. Late that day the original LOW was only a trough. The second LOW continued northeastward and at 0000 on the 18th was 990 mb near 50°N, 160°W. There were several reports of gales and waves near 15 ft. The storm dissipated on the 19th as it neared 145°W.

Figure 48.--The PRESIDENT TRUMAN was under the cloud shield north of the center, where the instability would be greater.

Again there were strong northerly winds off the California coast between the Pacific High and a heat LOW near Las Vegas starting on the 18th. The NDAD was off San Francisco with 54-kn winds from 340°; no waves were reported. Gale winds were still being found on the 21st, when a ship at 37°N, 125°W, found 25-ft swell waves.

This LOW suddenly popped up over the Sea of Japan late on the 17th. There were a few gales on the 18th. The PACBARONESS at 36°N, 145°E, had 39-kn winds from the north and 16-ft waves on the 19th. At 0600 the NEPTUNE DIAMOND north of the storm center

had 36-kn easterlies with 20-ft swells. At 1800 a Liberian ship had 35-kn gales, 20-ft seas, and 25-ft swells.

Late on the 20th the storm suddenly turned northwestward. At 0000 on the 21st it was 996 mb near 39°N, 157°E. A ship slightly north of the warm front reported 30-ft swells. The storm was weakening and it disappeared on the 22d.

The remainder of the month there were only weak cyclones. The primary feature was the Pacific High at about 1035 mb. The gradient between the HIGH and the heat LOW again tightened. On the 26th and 27th the DAVID STARR JORDON, PRESIDENT TRUMAN, and the USCGC YACONA had 38- to 50-kn northerly winds off northern California. On the 28th a Soviet ship (41°N, 125°W) had 52-kn winds. A United States ship (40°N, 125°W) found 40 kn and 20-ft waves. The gradient relaxed on the 29th as the Pacific High drifted westward.

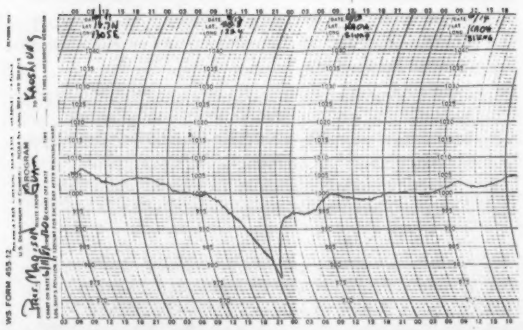
Tropical Cyclones, Western North Pacific--Ike was spawned by a low-pressure area that had moved westward across the South China Sea on the 8th. He became a tropical depression the following day some 60 mi north of the Paracel Islands. Ike was christened later that evening as winds reached tropical storm strength south of Hainan. On the 10th while still lacking organization, sustained winds of 40 kn with gusts to 60 kn were recorded at Sanhu Island about 60 mi from the center. Ike slowed and turned northeastward during the day. By the 12th his circulation had expanded to cover 500 mi, and he was moving east-northeastward at 13 kn. Early that same day the LUISE LEONHARDT encountered 45-kn winds 60 mi east-southeast of Ike's center; a short time later reconnaissance aircraft reported a 967-mb center at sea level. On the 13th the PRESIDENT MADISON enroute to Kaohsiung from Guam encountered 33-ft seas, 50-kn winds, and a 981.6-mb pressure some 35 mi from the center. The ship's barogram (fig. 49) indicates the pressure dropped another 6 mb as she headed for port. Ike crossed southern Taiwan near Kaohsiung and moved northeastward across the island causing severe flooding and killing five people. Late on the 13th a secondary center formed off the northern tip of Taiwan. The primary center dissipated off the east coast on the 14th, while the secondary center moved northeastward and dissipated the following day.

Ike was responsible for several marine mishaps in addition to a missing aircraft believed to have crashed on a cliff along the east coast of Taiwan. The RISING DRAGON was driven aground 100 mi north-northwest of Kaohsiung. The salvage tug SALVISCOUNT rescued 21 men from the stricken cargo ship. The ESSO SCOTIA broke her moorings from a scrapyard and sank a fishing vessel before colliding with the PROSPERITY. The bulkcarrier NIKEA reported hull and cargo damage due to the storm.

Typhoon June developed on the 17th about 480 mi east of central Luzon. As a tropical storm, she moved toward the northwest and intensified. By late on the 18th, just west of the Luzon Strait, June reached typhoon intensity (fig. 50). The following day she turned northward through a break in the subtropical ridge. Taiwan received its second beating in a week when June, sporting 80-kn winds, moved across the east coast on the 20th. Once north of Taiwan June weakened to tropical storm strength and recurved toward the northeast on the 21st. The following day she petered out just before reaching Kyushu.

Kelly originated as a tropical depression some 280 mi northwest of Yap Island on the 28th. He intensified to tropical storm strength late on the 30th just before

Figure 50.--June as she reached typhoon strength.



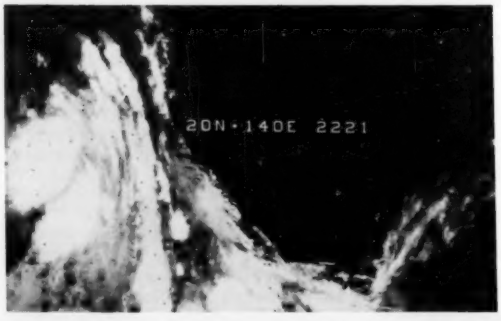


Figure 49.--The barogram from the PRESIDENT MADISON as she passed within 35 mi of Ike and the satellite view about 3 hr earlier.

crossing the Philippines near Catanduanes. Thunderstorms and torrential downpours resulted in severe flooding and landslides. About 200 Philippinos were killed, mostly residents near the Mayon Volcano. Steady rain loosened volcanic debris on the slopes causing an avalanche that destroyed nearly 600 homes. The BISMARCK SEA suffered an engine breakdown in the South China Sea on the 30th and because of the storm had to be towed to Manila.

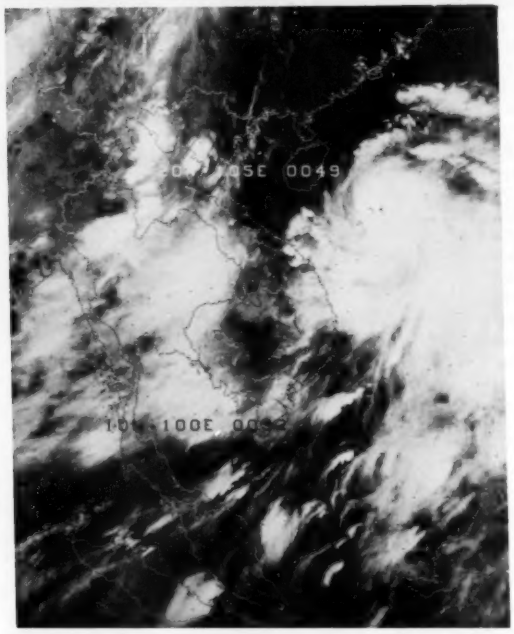


Figure 51.--Kelly develops a small eye upon reaching typhoon intensity at 0050 on the 3d.

Kelly entered the South China Sea on the 1st, moving westward at 10 kn; at this time he was a tropical depression. However, later in the day he regained tropical storm status, and by early on the 3d was at typhoon strength (fig. 51). Kelly was now moving toward the west-northwest. On the morning of the 3d the typhoon passed the Paracel Islands between Xisha Dao and Sanhu Dao. Sustained winds of 76 kn with gusts reaching 80 kn and a minimum sea-level pressure of 970.8 mb were recorded at Xisha Dao. The typhoon reached peak intensity that afternoon when surface winds were estimated at 80 kn around a 950-mb pressure center. The SAM EUN sank 22 mi east of Waglan Island just before dawn on the 4th as she headed for Hong Kong. Three American warships, the KIRK, TOWERS, and MIDWAY, rescued 19 survivors, while the KWANG TA rescued 7. About this time Kelly was crossing the southwest coast of Hainan. He landed on the Vietnam coast about 10 mi south of Hanoi on the 5th as a tropical depression.

Tropical Cyclones, Eastern North Pacific--Hurricane Beatriz came to life on the 28th some 360 mi southwest of Acapulco. Moving west-northwestward, then

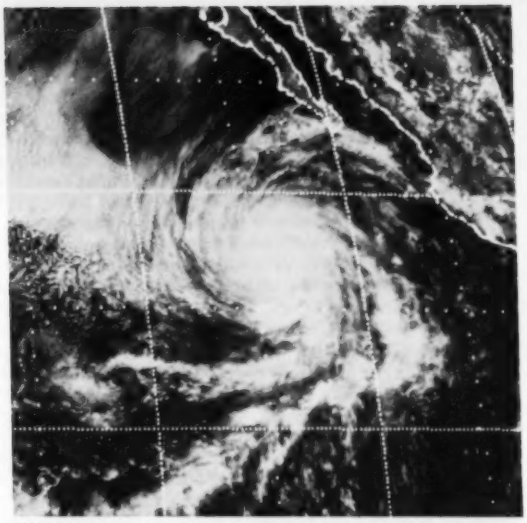


Figure 52.--Hurricane Beatriz has a round, spiral configuration.

northwestward, Beatriz reached tropical storm intensity on the 29th and hurricane strength the following day as she approached the 15th parallel near 111°W. On the 1st maximum winds were estimated at 75 kn with gales extending out 140 mi from her center, which was passing about 180 mi southwest of Socorro Island (fig. 52). As Beatriz crossed the 20th parallel, near 123°W, she dropped back to tropical storm strength. The following day she dissipated.

Casualties--The 83,102-ton American LNG AQUARIUS sustained heavy-weather damage on the 19th to 20th. The AEGIS IONIC was due Sasebo on the 24th with heavy weather and ice damage. The British DASHWOOD arrived Singapore on July 1 with weather damage. The PACIFIC FORESTER requested a survey for ice damage at Tamano on the 25th.

Other Casualties--The GALLEON EMERALD bound from Balboa to Melbourne suffered heavy weather on the 13th. The Australian IRON HUNTER was at Sydney on the 15th with heavy-weather damage.

ROUGH LOG, JULY 1981--There were fewer than normal cyclone tracks this month, and those that occurred were dispersed. Most were north of latitude 50°N. There were two areas where there was some concentration, one across eastern Siberia and the other along the eastern Aleutians and the Alaska Peninsula. None were exceptionally severe.

July is the one month of the year that the Aleutian Low does not show up in the climatological sea-level pressure pattern. It did not this month as the dispersed storm tracks would indicate. The only overwater feature was the large 1031-mb Pacific High centered near 43°N, 143°W. This was 6 mb higher and 400 mi northeast of its normal position.

For practical purposes the sea-level pressure over the ocean south of latitude 60°N was normal or above. There were two large positive centers, a

plus 8 mb near 49°N, 140°W, and a plus 7 mb near 40°N, 160°E. This higher than normal pressure effectively suppressed the cyclones.

The upper air flow was mainly zonal north of latitude 40°N. The only low-pressure center was near the North Pole. The trough along the U.S. West Coast was accentuated. There were three negative height areas at 700 mb. One was off the U.S. West Coast, another at midocean at about 45°N, and the third was over the South China Sea.

There were four tropical cyclones over the western ocean: tropical storms Lynn, Nina, and Ogden and typhoon Maury. There were three over the eastern ocean, tropical storms Calvin and Eugene and hurricane Dora.

Extratropical Cyclones--As far as extratropical cyclones were concerned, this was a very quiet month. The Pacific High was big and strong, while the cyclones were weak and small. This is to be expected during a summer month, but this month was exceptionally quiet. There were isolated instances of gale reports with individual cyclones, but no pattern of severity. Often, the wave height was very low, which made the observation suspect. Some of the stronger winds were off the California coast, associated with a tight gradient between the Pacific High and the Great Basin heat low. Even here the sea and swell waves were low.

During the first 2 weeks two LOWs moved northeastward from midocean to the Bering Sea, splitting the Pacific High into two cells. The majority of the LOWs occurred during this first 2 weeks.

At the beginning of the third week the HIGH was firmly entrenched off the Oregon coast with subcenters over midocean (fig. 53). It controlled the weather south of an approximate line from Kodiak to Hokkaido. A frontal wave east of Honshu on the 22d tried to develop into a storm, but it was defeated by high pressure to the north and east. At 0000 on the 23d a ship in the southerly flow reported 26-ft waves. On the eastern edge of the HIGH off northern California (40°N, 126°W) the AMERICA SUN and ARCO ALASKA had 35- to 40-kn gales with the waves reaching 12 ft at 1800 on the 22d.

This was the only extratropical storm this month that was significant according to the data; at that, it was only marginal. A frontal wave formed over the Sea of Okhotsk on the 25th. There were several low-pressure centers on the 26th. The DISCOVERER near 59°N, 174°W, had 36-kn winds from the south. The low-pressure centers combined into one by the 27th, and at 0000 the storm was 992 mb near 62°N, 180° (fig. 54). Bethel, Alaska, measured 45-kn southerly winds. At 1200 the OMMINESAN MARU (55°N, 167°W) had 39-kn winds. On the 28th the LOW was over the Chukchi Sea and the front was crossing the west coast of Alaska. The LOW continued northward with light winds behind the front.

Tropical Cyclones, Western North Pacific--Tropical storm Lynn formed about 440 mi east-southeast of Manila early on the 3d. She became a tropical storm that afternoon and followed a northwestward course toward Luzon. She crossed Luzon on the evening of the 4th, killing 17 people and leaving more than 65,000 homeless. Radar reports suggested that the eye turned northward over Luzon but failed to cross the Cordillera Central. Lynn formed a new center off the west coast

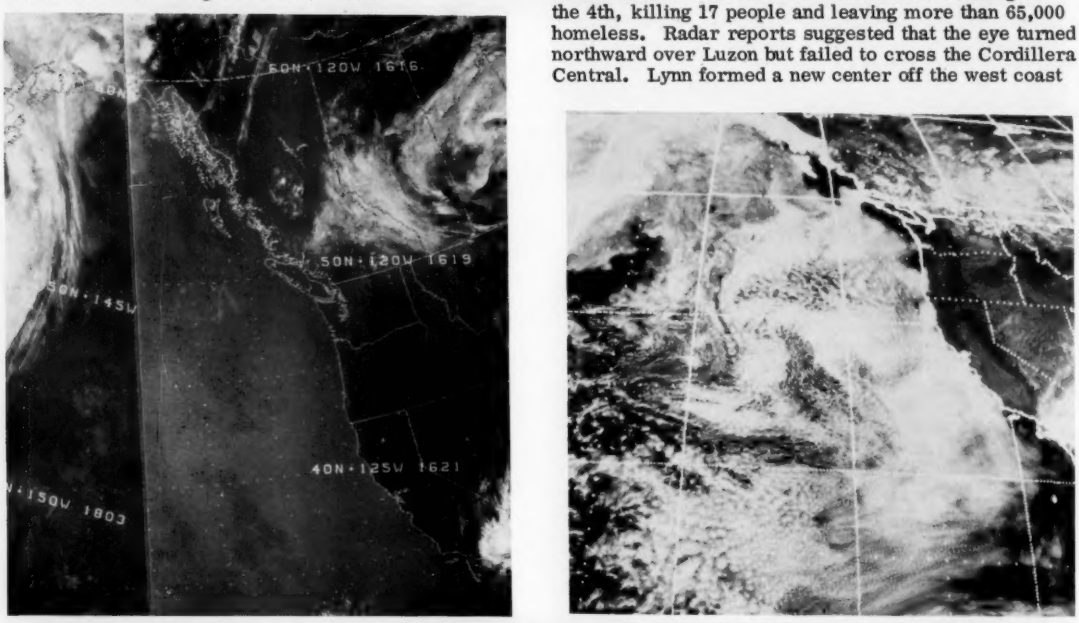


Figure 53.--The difference between two views of the Pacific High off the U.S. West Coast. The right view is a visual image from the synchronous satellite over 130°W. The fog and low stratus are very bright. The left view is from the polar-orbiting NOAA-A and is infrared. The fog and low clouds show only as grey, since they are nearly the same temperature as the water.

Figure 54.--The DISCOVERER was east of the storm and front at this time late on the 26th.

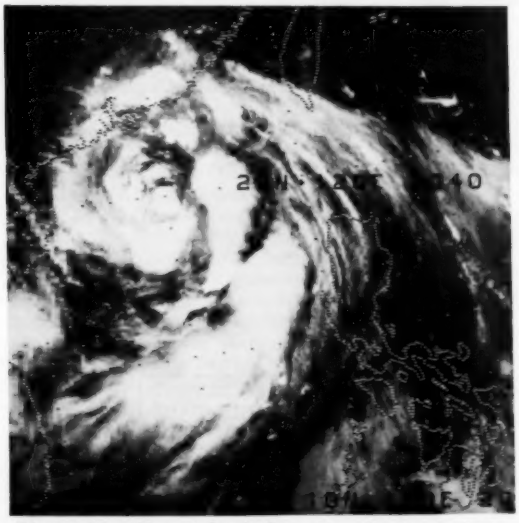


Figure 55.--Heavy clouds from Lynn have reached Hong Kong at this time on the 5th.

of Luzon, generating maximum winds of 40 kn. Moving northwestward at 15 kn across the South China Sea, Lynn continued to intensify. On the 5th the GANBARA encountered 55-kn winds about 85 mi northeast of the center. Lynn passed about 70 mi southwest of Pratas Island, where 30-kn winds and a 998.9-mb pressure were recorded (fig. 55). Early on the 6th Lynn slowed abruptly some 140 mi south-southeast of Hong Kong; she resumed her trek later that afternoon. On the 7th Lynn passed over St. John's Island, where winds hit 40 kn with gusts to 64 kn and sea-level pressure fell to 986.7 mb. Lynn crossed the China coast a few hours later and dissipated near Nanning in the evening. She caused considerable damage and killed five people in western Kwangtung province. In Hong Kong, sustained winds ranged from 30 to 48 kn with gusts from 50 to 70 kn. Gales lasted for more than 10 hr at Cheung Chau and Chek Lap Kok. Tides ran about 3 ft above normal, while waves of 6 to 10 ft were observed at Big Wave Bay.

Typhoon Maury was sighted in the Philippine Sea near 20°N, 130°E, on the 18th. As a tropical storm, he moved west-northwestward until crossing the 125th meridian, then turned northward as maximum winds climbed from 35 kn to 50 kn during the day. By early on the 19th Maury was centered off northern Taiwan near Ishigakijima (fig. 56). He turned due west upon reaching the 25th parallel, gained minimal typhoon strength, and ripped across northern Taiwan. Torrential rains and strong winds wreaked havoc. Nearly 11 in of rain fell over Taipei on the 19th resulting in widespread flooding. Tien Mou, a residential dis-

Figure 56.--Without an eye it is difficult to pinpoint the exact center of the storm. Ship observations could be the answer.

trict, was under 12 ft of water. At least 31 people died with 11 missing in northern and eastern Taiwan.

Just after Maury dissipated over China on the 20th, tropical storm Nina popped up just north of Taiwan. On the 22d the tropical depression headed west-northwestward toward the China coast. She gained minimal tropical storm strength before moving inland over Foo chow later in the day.

Tropical storm Ogden developed on the 27th near 22°N, 148°E. Heading west-northwestward, he attained tropical storm intensity the following day. Maximum winds climbed to 55 kn as Ogden moved through the Bonin Islands on the 29th. The next day Ogden moved across Kyushu. He survived that passage but finally petered out on the 1st, after recurving northward into the Yellow Sea, just southwest of Inchon, Korea.

Tropical Cyclones, Eastern North Pacific--Tropical storm Calvin came to life on the 4th some 300 mi southwest of Acapulco. He headed west-northwestward for a few hours but then turned toward the north-northwest. Calvin reached tropical storm strength about 1200 on the 5th as he crossed the 115th meridian near the 14th parallel. His forward speed was around 10 kn. Maximum winds never rose much above minimal tropical storm strength, and these gales extended out about 50 mi. Gusts were estimated at about 45 kn. Late on the 7th and early on the 8th maximum winds were estimated at 40 kn, as Calvin crossed the 20th parallel 180 mi west of the Mexican coast. Later on the 8th the storm weakened as he approached the tip of Baja California.

Hurricane Dora popped up on the 10th about 450 mi west-southwest of Acapulco. She headed west-northwestward, a course she would maintain for most of her life. A tropical storm on the 11th and 12th, Dora achieved hurricane intensity by the 13th just after crossing the 15th parallel near 113°W. The following day winds around her center climbed to an estimated 80 kn, with gales extending out to 90 mi in all directions (fig. 57). Her forward speed was about 15 kn. By late on the 15th winds dropped below hurricane strength. She continued to dissipate as she turned westward on the 16th close to the 20th parallel near 130°W.

Tropical storm Eugene sprang up some 360 mi west of Acapulco on the 16th. Moving west-northwestward, he reached tropical storm strength on the 18th after crossing the 110th meridian near 18°N. Maximum winds climbed to 45 kn on the 19th and gales extended out 60 mi in all directions. By the 20th Eugene was back to depression strength as he crossed the 20th parallel near 120°W. The following day all that was left was a weak low-level circulation devoid of significant convection.

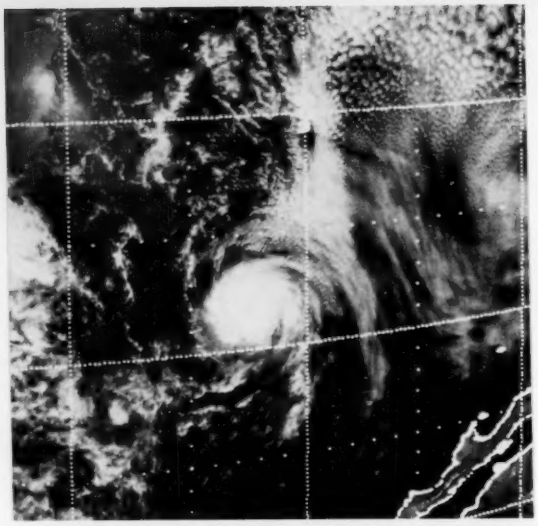


Figure 57.--Dora is a relatively small hurricane, but she fills a 5° latitude-longitude square.

Casualties--The floating hotel DARI LAUT was struck by lightning with a subsequent explosion on the 8th and sank between Caban and Maricaban Islands. On the 13th the 20,711-ton OGDEN CONGO and the 11,425-ton CHONG SUK collided in fog off southern Korea. There were no casualties. On the 15th the 3,000-ton SILVER STAR and the 2,000-ton DO NAM No. 1 collided in fog southeast of Pusan. There was no loss of life.

Other Casualties--The ASIA No. 12 sustained weather damage on the 1st on a voyage from Singapore to Dammam. On the 3d and 4th the IRON BARON experienced heavy weather in Bass Strait and the cargo shifted.

WE OF NOAA ARE MAKING USE OF THIS SMALL AMOUNT OF SPACE TO EXTEND OUR THANKS TO ALL THE SHIPS' OFFICERS WHO ROUTINELY TAKE SHIPBOARD WEATHER OBSERVATIONS. TO US, THESE EXCELLENT OBSERVATIONS ARE PRICELESS. WE CERTAINLY DO APPRECIATE RECEIVING THEM REGULARLY.

Marine Weather Diary

NORTH ATLANTIC, OCTOBER

WEATHER. The frequency and strength of the LOWs increases during October over the middle and higher latitudes. The Icelandic Low which is centered between Greenland and Iceland has decreased to a mean central pressure of 1000 mb. This increases the north-south pressure gradient bringing higher winds and more severe storms. The Azores High is near 35°N, 35°W, somewhat diminished in size but still 1020 mb. The mean air temperatures have dropped north of latitude 30°N, ranging from 0°C at Davis Strait to 28°C over the Caribbean Sea. Along latitude 40°N the temperature ranges from 15°C off New Jersey to 20°C at 40°W to 18°C off Portugal. The sea-surface temperatures lag behind the air temperatures. The 0°C line is on the southern Baffin Island coast with 28°C in the Gulf of Mexico and Caribbean Sea. Along latitude 40°N the range is from 16°C south of Long Island to 19°C off Porto, rising to 21°C at 40°W. The 98 percent range is near 4°C either side of the mean.

WINDS. North of 40°N in the Atlantic, the prevailing winds are west and southwesterly with an average force 4 to 6. South of this latitude the prevailing winds are north and northeasterly over the eastern half and east and southeasterly over the western half except northeasterly over the Gulf of Mexico with windspeeds averaging force 2 to 4. The Mediterranean Sea has average winds of force 2 to 4 except over the Gulf of Lions where they average force 3 to 5. The prevailing wind direction for the Mediterranean Sea is northwesterly except over the central region where it is quite variable producing a weak southerly component.

GALES. The frequency of winds of force 8 or greater has increased significantly from previous months for middle and higher latitudes. An analysis of eight ocean station vessels north of 40°N indicates that generally 90 to 95 percent of the gales have durations of less than 36 hr. Areas reporting the highest frequency of gales (10 percent or more) are the Gulf of Lions and an area that covers the central Atlantic extending north of 50°N into the Davis and Denmark Straits.

EXTRATROPICAL CYCLONES. The temperature contrast along the Atlantic coast, from the Carolinas to the Gulf of St. Lawrence, is conducive to cyclogenesis. Other major areas of cyclonic development include an egg-shaped area extending from 50°N, 40°W, to 58°N, 30°W, and an area that extends from the Davis Strait across Iceland into the Norwegian Sea. Numerous primary tracks cross southeastern Canada and the northeastern United States heading into most areas north of 60°N between Baffin Bay and Norway. Secondary tracks cross Hudson Bay and southern England.

TROPICAL CYCLONES. The hurricane season continues into October with the frequency of tropical cyclones decreasing significantly from September. An average of 2 to 3 tropical cyclones will reach force 8 or greater during October with a little over half of these reaching hurricane strength (force 12). Most storms form over the western Caribbean, but a few are spawned near the Lesser Antilles. The preferred storm tracks leading from the Caribbean either head toward the U.S. Gulf Coast or recurve across Florida toward open water.

WAVE HEIGHTS. During October wave heights of 12 ft or higher are encountered 10 percent or more of the time along a southwest-northeast axis that leads from just north of Bermuda to the Barents Sea and east from the Labrador Sea to the Bay of Biscay and North Sea. Forty percent, which is the highest frequency of occurrence, extends north of 48°N to 62°N and east of 45°W to 12°W. Within the eastern half of this 40 percent area, 10 percent of the observations show wave heights of 20 ft or higher.

VISIBILITIES. Observations reporting visibilities less than 2 mi are less frequent and widespread during October than any other month. Areas reporting 10-percent frequencies, the highest observed, are located over the Bay of Fundy, waters along the east coast of Newfoundland and Baffin Island, British coastal areas, and north of a line from Kap Farvel to Bear Island.

NORTH PACIFIC, OCTOBER

WEATHER. The Aleutian Low has deepened about 8 mb since last month bringing the mean central pressure to under 1000 mb with a clearly defined center over Kodiak Island in the Gulf of Alaska. Two centers appear in the Pacific High as it elongates and becomes less influential, each with a pressure of just over 1020 mb centered near 35°N, 178°E, and 35°N, 138°W. Pressures have increased over eastern Asia and the western Pacific as the Siberian High increases in strength and pushes over the Yellow Sea and the Sea of Japan. With the onset of winter the mean 0°C surface air temperature isotherm has moved south from the Chukchi Sea to across St. Lawrence Island in the Bering Sea. Mean temperatures range from -8°C at 70°N to over 28°C in the southwest Pacific south of 22°N. Along the 40th parallel, the mean temperature is near 14°C off both the California and Asian coasts and near 18°C at 145°W. Most temperatures (98 percent) fall between -20°C and 4°C over the Chukchi Sea, between 8°C and 24°C at 40°N, and between 24°C and 32°C at the Equator, except 20°C to 28°C off South America.

WINDS. By October, the Aleutian Low has become as dominant a feature as the Pacific Subtropical High. Westerly winds prevail between 35°N and 60°N with the exception of the northerly winds along Japan. At these latitudes the winds average force 4 to 6. North of 60°N, prevailing northerly winds average force 3 to 4 while over the East China Sea and South China Sea, northerly winds average force 3 to 6. From California to the Philippines, windspeeds average force 2 to 4. In this region the prevailing winds are easterly with the exception of northerly winds off California.

GALES. The frequency of winds of force 8 or greater have increased significantly from the previous warmer months. During October most gales are confined

primarily to the latitude band between 40°N and 60°N. Areas with the highest frequencies (10 percent or higher) are located to the east of the Kamchatka Peninsula, centered near 50°N, 163°E, and the region from the south coast of Alaska to 45°N and between 138°W to 179°E.

EXTRATROPICAL CYCLONES. The principal area of cyclogenesis now lies more east-west, extending from the Sea of Japan to near 170°E. The north-south extent of the area is from 30°N to 45°N. The primary storm tracks run from southwest to northeast with one extending from southeastern Japan to near 52°N, 158°W, where it divides into a northerly track to Alaska and an easterly one to Canada. A second track runs from southern Sakhalin across the Commander Islands into the western Bering Sea with a third track running from west to east just south of the western edge of the Aleutian Chain.

TROPICAL CYCLONES. The frequency of tropical cyclones begins to decrease in October. An average of 2.2 tropical cyclones per year of force 8 or greater ($\geq$ 34 kn) occur in the eastern North Pacific and 4.3 in the western North Pacific. Of these, an average of 1.0 will reach hurricane strength ($\geq$ 64 kn) in the eastern North Pacific and 3.3 in the western North Pacific. The preferred track over the western ocean is westward along latitude 15°N from 160°E into the South China Sea with about half turning northeastward east of Luzon passing east of Japan. Over the eastern ocean they form south of Guatemala and track toward the Baja Peninsula or parallel latitude 17°N.

WAVE HEIGHTS. In general, most areas between 25°N and the northern Bering Sea and between Japan and North America experience wave heights of at least 12 ft, 10 percent or more of the time. Ten percent frequencies are also encountered from the northern Philippines to the East China Sea and over the east central Philippine Sea. Frequencies increase over the North Pacific to a maximum of 30 percent from south of Kodiak Island to latitude 50°N between longitude 140°W and the Aleutians.

VISIBILITES. During October, visibilties of less than 2 mi are less frequent and widespread than at any time of the year, but most regions north of 40°N have observed frequencies of 5 percent or more. The highest frequencies, of just over 10 percent, occur northwest of St. Lawrence Island, along the coastal region of North America from central California to southeastern Alaska, and in midocean along the 45th parallel from Kuril Islands to 160°W and from 145°W to 135°W.

NORTH ATLANTIC, NOVEMBER

WEATHER. The Icelandic Low is still centered between Kap Farvel and Keflavik with a central pressure of 1002 mb slightly higher than October or December. This appears to be the result of fewer low-pressure centers traversing the area, not weaker storms, as the mean wind has increased slightly and high waves are found more frequently. The Azores High at 1021 mb has shifted northeastward to 38°N, 30°W. The mean air temperature shows a marked decrease this month. The mean ranges from -4°C over Baffin Bay to a small area of 28°C over the Caribbean Sea. The mean temperatures along the 40°N parallel ranges from 11°C off New Jersey to a high of 18°C at 40°W to 15°C off the Portuguese Coast. The 98-percent temperature range has increased north of the Tropics, especially over the western ocean where it is as much as 10°C below the mean and 8°C warmer. The sea-surface temperatures are slowly cooling, ranging from -2°C near Baffin Island to 28°C in the Tropics. The mean temperatures along 40°N latitude range from 13°C off New Jersey to 20°C near 55°W to 16°C off Portugal. The 98-percent range is still about 4°C either side of the mean except off the U.S. coast.

WINDS. Prevailing westerly winds of force 4 to 6 span most of the Atlantic between 40°N and 60°N. Winds north of 60°N are quite variable, averaging force 4 to 6, and in establishing a prevailing direction they tend to be southwesterly over the eastern Norwegian Sea and northerly between 5°W and Hudson Bay. South of 40°N, the prevailing winds are generally from the east and northeast averaging force 2 to 4.

GALES. Winds of force 8 or greater have increased from the previous month with nearly all unprotected areas north of 38°N reaching a frequency of 5 percent. Most of the central Atlantic north of 45°N reaches 10 percent with the highest frequency being off the southeast tip of Greenland, where it approaches 20 percent.

EXTRATROPICAL CYCLONES. Major areas of cyclogenesis include an area that extends along the coast from the southeastern United States to Nova Scotia, an elliptical area (approximately 14 degrees by 9 degrees) centered near 50°N, 40°W, and an area extending from southeast Greenland to near 05°W. Leading from the Great Lakes, the majority of extratropical lows cross the Gulf of St. Lawrence and head for southwest Greenland. Other primary tracks lead from near 38°N, 60°W, and cross Iceland into the Norwegian Sea, and across Hudson Bay. Secondary tracks lead from Lake Winnipeg across Ontario, across the British Isles and southern Scandinavia into eastern Europe, and across the northwestern Mediterranean from northern Spain to Yugoslavia.

TROPICAL CYCLONES. Tropical disturbances have decreased substantially since the warmer months. On the average, only 7 cyclones in 10 years will reach force 8 or greater, with only 3 of these reaching hurricane strength (force 12). Most of these storms develop over the Caribbean Sea with the preferred tracks either crossing the Yucatan Peninsula bound for the eastern Gulf States or crossing Cuba and heading northeastward into open water.

WAVE HEIGHTS. Wave heights of 12 ft or more are encountered more than 10 percent of the time over most open ocean north of 32°N and east of the Davis Strait. Frequencies of 10 percent are also found in the Mediterranean Sea between Majorca and Sardinia. The region south of Iceland between Greenland and Ireland observes wave heights of at least 12 ft 40 percent of the time, and of at least 20 ft 10 percent of the time. Within this region, a small area centered near 57°N 20°W, experiences wave heights of 12 ft or more 50

percent of the time, and 20 ft or more 15 percent of the time.

VISIBILITIES. The percent frequency of visibility less than 2 mi has only slightly increased since October. Areas reporting frequencies of 10 percent or more include: the Bay of Fundy; the Gulf of St. Lawrence; coastal areas off Newfoundland and Baffin Island; southern coastal regions off Greenland; the area north of a line from Angmagssalik, Greenland, to the Barents Sea; and portions of the Irish Sea and the southern part of the North Sea.

NORTH PACIFIC, NOVEMBER

WEATHER. Although mean temperatures are lower, only a slight southerly movement of the Aleutian Low is noted as it becomes centered near 57°N, 150°W with its mean central pressure remaining just under 1000 mb. Along the 30th parallel, the Pacific High extends from California to 150°E. Its mean central pressure of just over 1020 mb is centered near 32°N, 140°W. Pressures continue to rise near Japan and Korea as the Asiatic High continues to build. There continues to be a marked decrease in the mean air temperature off the Asian coast as far south as Taiwan. Off southern Kamchatka the temperature dropped from 7°C to 1°C. Means range from a -16°C over the Chukchi Sea to over 28°C in the southwest Pacific between the Equator and 20°N. Along the 40th parallel, means range from 8°C off Asia to 15°C in the eastern Pacific. Less than 2 percent of the observations fall outside the range of -32°C to 0°C in the Chukchi Sea, -2°C to 20°C at 40°N, and 20°C to 32°C at the Equator with the colder water off Ecuador. The mean sea-surface temperature ranges from freezing across the northern Bering Sea to 28°C south of 20°N. Along latitude 40°N the temperature averages 16°C except 12°C over the Sea of Japan and 14°C off California. The 98 percent range remains at about 4°C either side of the mean.

WINDS. The intensification of the Aleutian Low since October has had little effect on the general circulation pattern. The mean wind flow between 35°N and 60°N is west to southwest while south of 35°N, it is east to northeast. The exceptions are the prevailing northerly winds that are observed off California and in an area that extends from Japan to Malaysia. Winds average force 4 to 6 over the South China Sea and in most regions north of 30°N. The remaining areas of the North Pacific average force 3 to 5.

GALES. The frequency of gales ($\geq$ 34 kn) continues to increase with most unprotected areas between 30°N and 65°N reporting frequencies of at least 5 percent. The areas of highest frequency (10 percent or greater) stretch from the Gulf of Alaska to the Kuril Islands and from 40°N to the Bering Sea.

EXTRATROPICAL CYCLONES. The principal area of cyclogenesis over the North Pacific extends from the Sea of Japan to near 175°W and from 30°N to 47°N. The migration of lows across the Pacific move primarily from southwest to northeast following three primary tracks. The westernmost track extends from southeastern Russia across the Kuril Islands into the western portion of the Bering Sea. The central storm track extends from a region to the east of central Japan to Bristol Bay and the easternmost track extends from near 43°N, 175°W to near 47°N, 160°W where it branches northeastward into Alaska and eastward into the northwestern United States.

TROPICAL CYCLONES. Tropical cyclone activity continues to decrease across the North Pacific with the most significant decreases occuring in the eastern North Pacific. During an average time span of 10 years one can expect only 3 storms of force 8 or greater in the eastern North Pacific. Of these, it is unlikely that any will reach hurricane strength. In the western North Pacific for an equivalent period, 29 can be expected to reach force 8 or greater; of these, 21 are expected to reach force 12.

WAVE HEIGHTS. Wave heights of 12 ft or higher are encountered 10 percent or more of the time in most areas between the Hawaiian Islands and St. Lawrence Island and between Japan and North America. Ten percent frequencies are also encountered east of the Hawaiian Islands and from Vietnam to Okinawa. Frequencies increase to 20 percent over the South China Sea and to 30 percent between latitudes 45°N and 55°N and longitudes 135°W and 160°E.

VISIBILITIES. The percent of observations reporting visibilities of less than 2 mi has increased slightly since October. Most regions north of 40°N, report frequencies of at least 10 percent running northwest of a line from northern Japan to southwestern Alaska. Frequencies of 10 percent are also observed off the California coast near San Francisco, between Vancouver Island and the mainland, and in an area with a radius of approximately 300 mi centered near 50°N, 150°W. Frequencies of 20 percent are reported in the north central Sea of Okhotsk and in a narrow band that extends from the Commander Islands to the Bering Strait.

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Washington, D. C. 20235

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Com-210
Second Class

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Effective with Volume 26, No. 1, nonofficial subscribers to the Mariners Weather Log will be required to pay for the publication. The price will be $8.00 domestic and $10.00 foreign per year. Single copies will be $3.00 domestic and $3.75 foreign. The subscription and single issue requests will be handled by the Superintendent of Documents. Details for subscribing will be published in the November-December 1981 issue.

Also effective with the first issue of 1982 (Vol. 26, No. 1) the Mariners Weather Log will become a quarterly publication with Winter, Spring, Summer, and Fall issues. These will contain the annual articles plus articles of interest to the marine community. The only major change will be in the Marine Weather Review. The Rough and Smooth Logs will be replaced with a single Weather Log covering 3-month periods approximately 6 to 9 months previous. The Marine Weather Diary will be discontinued as it is published on Pilot Charts.

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